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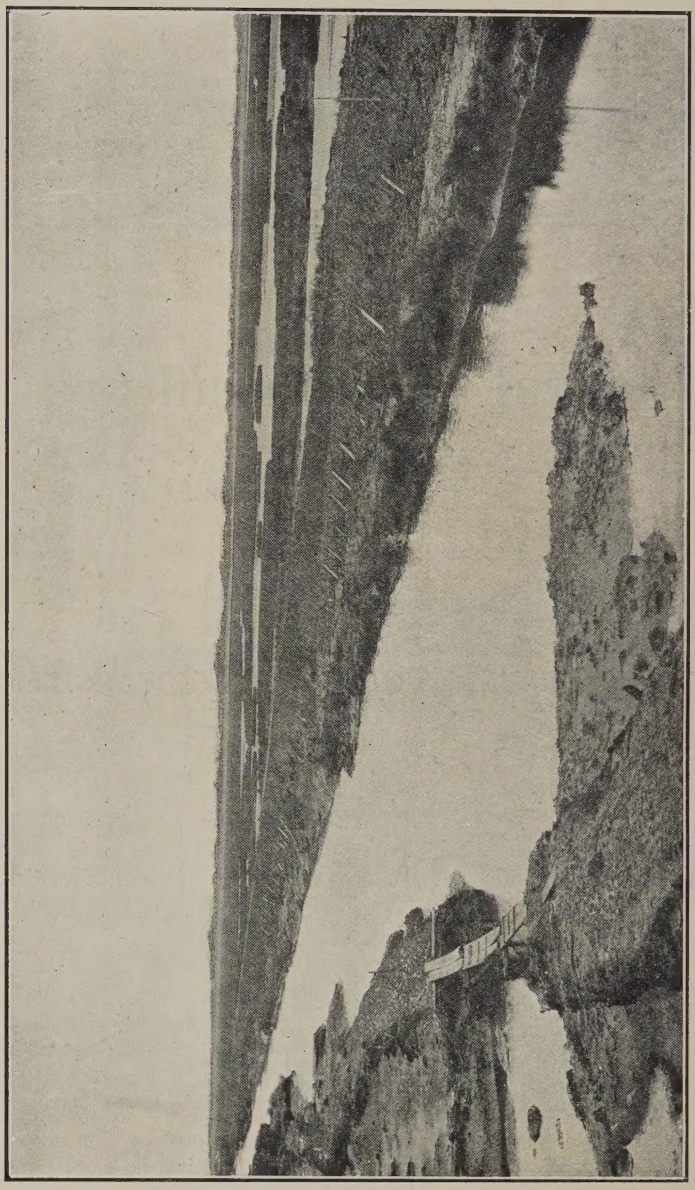
ESTUARY RECLAMATION AT INVERCARGILL.

REMARKABLE AGRICULTURAL CONVERSION.

W. J. McCULLOCH, Fields Supervisor, Invercargill.

A LARGE scheme of reclamation of the tidal flats forming the upper part of the New River Estuary, facing Invercargill City, was commenced some seven years ago. Owing to various causes the work of constructing embankments to hold out the tidal waters took longer than was originally estimated, but after overcoming many difficulties a success has been achieved for which the authorities deserve the greatest credit. From initial results which already have been achieved it is safe to predict that this reclaimed estuary land will in the near future rank with the finest dairying-lands of Southland.

The reclamation-work has been carried out jointly by the Invercargill City Corporation, which controls the New River Estuary, and the Department of Justice. Under this arrangement the Corporation

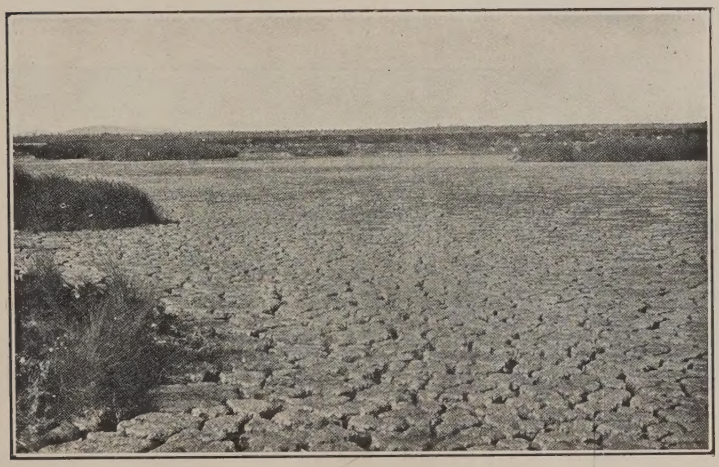


NEW RIVER ESTUARY RECLAMATION IN THE MAKING.

Looking across eastern embankment into reclamation area from Invercargill side, showing class of country forming the upper estuary.

found material, plant, and skilled labour and supervision; while the Justice Department supplied prison labour, and officers to supervise the latter.

The whole of the area reclaimed was originally submerged by high spring tides, and partially so by ordinary tides, the general level of the land varying from 6 ft. maximum to zero above ordinary low-water level. The embankment at the south of the area, and which runs across the estuary, has a total length of 1¼ miles, with a full width of 34 ft., and is constructed principally of sand with a mixture of harbour mud. The exposed face is protected with rubble brought from the Bluff and



MUD-FLATS ON RECLAIMED AREA.

Photographed after the tidal waters were finally shut out. Note the shrinkage, showing a soil-texture with good drainage.

Greenhills. The eastern stop-bank, facing the town, has a total length of 1¾ miles, with a top width of 5 ft. and a base of 20 ft. approximately. It is constructed of harbour mud, and is faced with fascines, waewae sod, and stone. There are four flood-culverts fitted with flood-gates for the purpose of draining. At a later date an extra culvert is to be constructed. The average height of the embankments is from 6 ft. to 11 ft. The plant used in construction comprised dredges, ballast-trucks, and locomotives, while part of the material was barrowed.

The total cost, so far, to the Corporation has been approximately £24,000. The area within the embankments is 2,250 acres, of

which the Justice Department holds 650 acres in return for the prison labour supplied. The Corporation proposes to improve the remaining 1,600 acres by roading, draining, and laying down pasture. This season it is sowing in mixed grasses and clovers some 300 acres. The areas so improved are subsequently to be leased as dairy farms.

THE REFORMATORY PRISON FARM.

As already indicated, this area comprises 650 acres of the reclaimed land, and it is now being developed as a dairy farm by the Justice Department, with the advice and direction of the Department of Agriculture.* The area is in every respect similar to other portions of the reclamation, and has been built up by the sedimentary action

MOWING SURFACE-SOWN GRASS AND CLOVER ON THE PRISON FARM AREA.

Eight months after sowing, and less than a year after the water was finally shut out.

of tide and river for past ages. Some twelve or fifteen months ago it was finally shut off from the estuarial waters.

After the surface water had drained off, the soil, which is of a silty free nature to a depth of some 10 ft. or 12 ft., immediately began to shrink in all directions, opening up in large fissures, especially in the lower mud-flats, thus demonstrating a texture of soil with good natural drainage qualities. It should be explained that the present surface of the area is made up of tortuous mud-channels, from a few feet wide to many chains, between which are large areas of land slightly higher and covered with the only natural vegetation—waewae

*Mr. McCulloch, who for some time past had been informally advising the Justice Department in connection with the development of this area, was in December last appointed Agricultural Adviser and Farming Director to the Prison Farm.—EDITOR.

or salt-rush. This growth is very dense, and burns freely in the autumn.

In April, 1917, an area of something under 40 acres of waewae was burned off, and surface-sown with a mixture of grasses and clovers as follows: Italian rye-grass, 6 lb.; perennial rye-grass, 10 lb.; cocksfoot, 6 lb.; timothy, 2 lb.; meadow-foxtail, 3 lb.; meadow-fescue, 2 lb.; crested dogstail, ½ lb.; *Poa trivialis*, ½ lb.; cow-grass, 2 lb.; alsike, 2 lb.; white clover, 2 lb.: total, 38 lb. per acre.

There was a certain element of risk in sowing clovers in Southland so late in the season. However, no harm followed, as was testified by results. This initial area was dealt with more in the way of experiment, as it was thought that the large amount of sodium

THE HAY CROP IN COCKS ON THE SAME AREA.

chloride (salt) presumed to be present in a soil saturated with sea-water for so long might act detrimentally on the growth of ordinary farm crops, but such was not the case in this instance.

In November last (eight months later) a most luxuriant growth resulted, and before arrangements could be made to have it stocked there was danger that the rye-grasses and alsike would smother out other slower permanent grasses beneath. To relieve the situation the crop was therefore cut, and something over 50 tons of first-class hay was well saved. Since then forty yearling heifers, two bulls, and five horses have grazed the area continually; and the feed is gaining all the time, especially the clovers. A few acres of turnips were surface-sown, and, although late, are growing well. A further area of approximately 175 acres is being surface-sown in permanent pasture this autumn; also some 60 or 70 acres are to be ploughed in readiness for next season's oats and turnip crops.

Turnips were twice surface-sown on portions of one of the dry mud-channels, but without success, the seed appearing not to germinate. It is doubtful if clovers will take on these mud areas at present, as the grass-mixture mentioned was also tried, but only rye-grass has appeared above the surface so far.

A considerable amount of ditching has been done, following all the branches of the dry mud-channels, with the hope of removing the

YOUNG CATTLE ON THE PRISON FARM AREA.

The first stock grazed, following the hay crop.

sodium chloride as much as possible by drainage. These ditches are being left open for a lengthy period on account of the shrinkage taking place, and when necessary will be filled in, using manuka underneath.

It is intended, eventually, to milk a large herd on the farm, and the necessary buildings and plant are now being considered, together with water-supply and shelter. Two pedigree Friesian bulls have been purchased, and will be used on crossbred heifers in the meantime. Later on, however, it is hoped to work into a purebred Friesian herd.

Field 35 at Ruakura, one of the reclaimed-swamp paddocks, was cut for hay this season. Most of the pasture consisted of white and red clover, and in order to make special use of this crop for further reclamation purposes the white clover had been allowed to ripen seed. The red clover was in full flower at the time of cutting, the quality of the hay being very good. It is intended to utilize the whole of this hay for the pasture development of adjacent new swamp areas, by feeding it to dry cows grazing thereon during the winter. By this procedure the seed of the white clover will be deposited on the swamp-land under good conditions for germination.

DETERIORATION IN FENCING-WIRE.

TESTING BY POST AND TELEGRAPH DEPARTMENT.

J. ORCHISTON, M.I.E.E., Chief Telegraph Engineer.

MUCH loss to the farming interests throughout the Dominion has resulted during recent years from the use of cheap German and other low-grade fencing-wire, which only had a life of half a dozen years or so. The loss can be safely placed at hundreds of thousands of pounds.

Some time ago there was a considerable amount of investigation in the United States as to the cause of the rapid deterioration of modern wire as compared to that produced formerly. The conclusion arrived at was that the "chief reason for the deterioration was due to the admixture of manganese in the process of manufacturing the steel." Each molecule of manganese left in the metal will set up local galvanic action, with the result that the wire will become pock-marked, or flayed off in junks, as if some sharp instrument had been used to bite pieces out of the metal. Other impurities in the metal will, of course, all tend to its disintegration. The purer the metal, the less oxidation—in other words, the longer it will last.

Prior to some forty years ago all wire was made of ordinary iron, but on the advent of what might be termed the steel era the manufacture of iron wire practically ceased. The cheaper steel wire also gained favour from the fact that it would stand a greater strain before stretching. After some years it was discovered that it was not so lasting as the previous iron wire. It then became the practice to largely galvanize fencing-wire, but even this did not make up for the impurities resulting from the cheaper methods of manufacture. The Germans seem to have led the way in regard to cheapness and poor quality; and British firms had to follow suit or simply lose the trade, as the average farmer had and has no means of telling one wire from another. The cheap German wire, from outward appearance, looks just as well as, and, in fact, sometimes better than, the superior British article. I leave it to the farmers themselves to judge how many have knowingly bought German wire because it was 10s. a ton cheaper, and have been sorry for themselves afterwards.

The Post and Telegraph Department is, of course, the largest user of wire in the Dominion, and an outline of its experience may

therefore be of interest. In 1864 the General Government commenced the erection of telegraph-lines from Marlborough to Southland. A considerable quantity of the wire then erected is still in use, and what has been dismantled was principally on account of alterations to the route, &c. A great deal of the wire erected in both Islands during the "sixties" is still doing good work, and likely to last many years longer if left alone. After 1882 I observed a marked difference in the class of wire coming to hand, and subsequently learnt that it was steel, and that as the British Post Office had agreed to take steel wire at a cheaper rate than the previous iron wire the manufacturers had practically ceased to make iron telegraph-wire by the old process. The result is that the wire erected during the later "eighties" and "nineties" is not so good as that of the "sixties" and "seventies," and most of it will have to be replaced before that erected during the earlier period.

At odd times between the years 1895 and 1910, when the supply of standard wire had run out, some fencing-wire was purchased to complete pressing works. In one case such wire erected in 1905 began to fall down in 1911, and had to be wholly renewed in 1912—a total life of only seven years—whereas, as already indicated, much of the fifty-three-year-old wire in the South Island is still serviceable.

Naturally, one is apt to ask, Can nothing be done to remedy or check the use of such inferior material? There is a very simple means of arriving at the approximate purity of the iron. The purer any metal is, the greater its electrical conductivity; consequently the more impurities, the poorer the conductor. Reckoning the conductivity of absolutely pure iron at 100 per cent., the best class of telegraph-wire is expected to represent 97 per cent. from an electrical-conductivity point of view. It is doubtful, however, if any steel wire can be obtained as high as this; and the British Post Office Telegraphs has set the minimum standard as low as 87 per cent., which has been the minimum adopted in New Zealand. I am, however, of opinion that this is too low, and it is proposed to raise the standard. The old telegraph-wire erected in the "sixties" approximated 95 per cent. Some fencing-wire tested by me has been as low as 50 per cent., which is a clear indication that such wire will have a short life.

Some recent importations of a new class of iron wire manufactured in America have reached the 97-per-cent. mark, and it is anticipated that this wire will be good for at least fifty years, although the galvanizing does not comply with the specifications of the New Zealand Telegraphs. During the last seven years hundreds of tons of telegraph-wire have been rejected in Wellington, much to the disgust of the manufacturers and their local representatives.

Although the purity of the metal is of primary importance from a lasting point of view, it is also desirable that the wire should be

well galvanized; and I may here state I have never found any fencing-wire which would comply with our departmental specifications in this respect. In so far as the tensile strength of the low-grade wire is concerned, little fault can be found with it when new—in fact, it will invariably bear a greater strain before stretching than the first-class article.

THE OFFICIAL TEST.

With a view to assisting those in need of good wire the Postmaster-General has approved of the Post and Telegraph Department Laboratory, in Wellington, undertaking the testing of fencing-wire for the percentage of conductivity, and also for galvanizing, at the nominal charge of 2s. 6d. per sample. Each sample should consist of 11 ft., to be made up in a coil of not less than, say, 9 in. in diameter, and free from kinks. Further particulars of the scheme, and information as to forwarding and payment, may be obtained on inquiry at any post-office, and will also be published in the Postal Guide.

LUCERNE AT SOMES ISLAND.

An area of about half an acre of lucerne has been laid down by the Department during the past season at Somes Island Quarantine-station, where the clay soil and formation are fairly typical of the better hills round Wellington. The ground was turned over in the spring of 1916, from turf containing a fair proportion of clover, and dressed with burned lime at the rate of 1 ton per acre. It was under vegetables during that season, and in April, 1917, was sown with oats. The oats were turned under early in August, and a further dressing given of ½ ton of carbonate of lime and 2 cwt. basic slag per acre. The lucerne-seed was sown on the 10th October, in rows 15 in. apart, at the rate of 12 lb. to the acre. Superphosphate was drilled in with the seed at the rate of 4 cwt. to the acre. The ground was well worked before sowing, and was rolled immediately before and after sowing. No inoculated soil was used. The lucerne came away well, and the crop has already been cut three times, and a fourth cut will be secured this season. The first cut was made on the 24th November, being six weeks and three days from date of sowing, when the lucerne was 7 in. to 8 in. high; this was left on the ground. The second cut was made during the second week in January, when the crop was 20 in. high and filled the space between the drills. The third cut was made during the third week in February, when about 16 in. high and very dense and leafy. The fourth cut will be shorter but more dense and leafy than any of the previous cuts. Half the area was sown in Hunter River and half in Marlborough seed; so far there is no appreciable difference in growth between the two. How the lucerne holds in this soil and situation is a matter which will be watched with interest. If it becomes well established the lucerne will be very useful and acceptable for feeding to quarantined stock on the island.—*H. Munro, Inspector of Stock, Wellington.*

ALGAROBA, CAROB, OR LOCUST TREES (CERATONIA SILIQUA).

T. W. KIRK, Director, Horticulture Division.

SEVERAL notes on the carob tree and beans have been published recently in the *Journal*. The object of the present statement is to throw more light on a subject that has aroused a considerable amount of interest, and concerning which a good deal of correspondence has been received. Some confusion existing as to what trees the various synonymous names referred to, questions were submitted to the Director of the Royal Botanic Gardens, Kew. The answers received, and published in last December *Journal*, established the fact that the term "algaroba" is applied to a number of trees, including *Ceratonia siliqua;* so also is the term "locust"; but the term "St. John's bread" is applied only to *Ceratonia siliqua*.

Subsequent to submitting these queries to Kew doubts arose in other directions. A statement gained currency that extensive new plantings of algaroba-trees had been made on the Island of Cyprus, and that the tree planted was not *Ceratonia siliqua* but *Prosopis juliflora*, a native of the West Indies and Central America. A further communication was therefore sent to Kew, inquiring as to what tree had really been planted in Cyprus, and if the *Ceratonia* is invariably diœcious, rendering it necessary to intergraft the trees to induce fruiting. The reply received was drafted by Dr. Stapf, who quotes his report on the same subject to the Cyprus Government. The letter makes it plain that *Ceratonia siliqua* is the algaroba planted in Cyprus, not *Prosopis juliflora*.

Dr. Stapf's report on the sexuality of the flowers of *Ceratonia siliqua* is a lengthy document, covering all that is known on the subject, and detailing some new and interesting discoveries. The following is a précis of the report:—

Until 1892 three sexual states of flowers of the algaroba-tree were known—(1) hermaphrodite flowers with anthers 3 mm. long and borne on filaments 5–7 mm. long, and normal pistils developing into seed-bearing pods; (2) male flowers with stamens as in the hermaphrodite flowers, but the pistils reduced to a small knob; (3) female flowers with the stamens reduced to minute staminoides inserted between the disk and the sepals, and consisting merely of barren parenchymatous tissue, and the pistils as in the hermaphrodite flowers: each of these forms being normally confined to one individual, so that one may speak of hermaphrodite trees, male trees, and female trees.

Hermaphrodite trees are rare, and seem only to occur normally in a Spanish race (matalafan). The tree being thus—apart from this hermaphrodite race—practically dicecious, the presence of male trees, or male branches grafted on female trees, was considered necessary for the production of an algaroba crop. In 1892, however, Heckel and Schlagdenhauffen discovered another sexual condition of the algaroba-tree—the fourth—in the Department of Var in southern France. The trees when in flower had the appearance of female trees, but on closer examination it was found the flowers were actually hermaphrodite, though of a kind not recorded before, the stamens being reduced to small subsessile anthers shorter than the sepals, but otherwise normal and holding normal pollen. Most of these trees were of the kind described; in some, however, the anthers were found to be barren except a few terminal flowers, and the trees bearing these predominantly functionally female flowers were poor yielders, whilst all the others produced abundant crops whether there was a male tree present or not. In the Department of Var and neighbourhood all the algaroba-trees, whether wild or cultivated, are either male or the kind described, approaching at times the female form by the sterilization of the majority of the male flowers.

Regarding female trees in Cyprus, it has been stated by Gennadius, and more recently by Mr. Solomides, Entomologist to the Cyprus Government, that in Cyprus there are extensive plantations of algaroba-trees which are exclusively female, and yet bear abundant fruit with normal seed. In Solomides's view, however, the flowers are only apparently female, being in reality clistogamous. This problem has not as yet been solved, but it is thought they are similar to the trees of the French Riviera and North Africa, and though pollen may be present the aid of small insects is probably required to bring about cross-fertilization. Relying on the experience of the algaroba planters in the Mediterranean countries, it would seem that fertilization is assured by the general predominance of hermaphrodite flowers, and that, therefore, budding may profitably be done from any well-yielding trees, even of the so-called female type of Cyprus, without the introduction of male trees, although the presence of male trees would probably enhance the chances of increased fertilization, and consequently increased fruiting.

Nothing is known as to the origin of the Cyprus variety. The cultivation there, as in other parts of the Levant, is evidently of very long standing, and is probably the oldest on record.

The scene depicted in the frontispiece of this issue is on one of the upper reaches of the Wanganui River, and shows a flock of sheep about to be swum over the stream.

THE AGRICULTURAL TRACTOR.

POINTS FOR NEW ZEALAND FARMERS.

W. C. ROBINSON, Head Office, Wellington.

THE farmers of New Zealand, like their *confrères* in other food-producing countries of the world, have of late given a great deal of attention to the agricultural tractor. This is largely a result of the extreme shortage of suitable farm labour and consequent high wages demanded by the comparatively few available men, together with the high cost of horse-feed, which have made our agriculturists turn to some other means of preparing their land and conducting other farm operations usually done by horses.

The tractor is not by any means a new machine, for it made its first appearance in England about 1902. In New Zealand the Department of Agriculture has had a tractor at one of its experimental farms for some eight years. It cannot be said, however, that this particular machine has been a success. While the tractor of to-day has many shortcomings, and is still capable of development, it is a greatly improved machine and a valuable aid to agriculture, provided farmers are prepared to give it fair treatment and not expect impossibilities.

There are a number of makes—mostly American—represented in New Zealand, each having its own advantages, and it is not feasible to say which machine is the best. The writer has been watching very closely the results of trials held in England and Scotland by various agricultural societies, and no type or make seems to stand out more prominently than others; in fact, at the last trial held by the Highland and Agricultural Society of Scotland the machine that showed to advantage was a three-wheeled one, a type that has been condemned by a number of sound engineers. Strange to say, the machine that many people saw great possibilities for—the caterpillar type—received no praise from the official observers at these trials. To use their own words, they reported that "as far as the committee were able to observe, the caterpillar machine has not been shown to have any advantage in gripping-power over the best type of wheel machine, and when it has to encounter a stiff gradient on greasy land it is very liable to slip." This opinion is held by a number of observers at other trials and by others competent to judge.

TYPES OF TRACTORS.

Tractors (the internal-combustion class only being under review for the purposes of this article) are of two types—namely, the caterpillar and the wheel machine. The former, of course, is in a class by itself, but the wheel machines are of three sub-types—two-wheeled, three-wheeled, and four-wheeled. It cannot be ascertained that any two-wheeled machines have been imported into New Zealand, and as they have not come much before the public at any British trials nothing will be said here in regard to them.

Some specimens of the three-wheel machine are at work in this country and giving good results. This type of tractor is manufactured in different styles by different makers. Take, for instance, the Samson Sieve Grip, with its open wheels. It has two driving-wheels and one steering-wheel, and it is driven by a fairly high-speed four-cylinder motor-car-type engine working on benzine or distillate. One model of the Emerson has two steering-wheels and one broad-faced driving-wheel. This machine is also driven by a four-cylinder car-type engine, but not high speed. The makers claim that it will work on benzine, distillate, or kerosene. Another three-wheeled machine is the Bull, which has one steering-wheel, one large driving-wheel working in the furrow, and one idle wheel (the same size as the steering-wheel) running on the land off the same axle as the driving-wheel. This machine has not yet been imported into New Zealand, but has given a good account of itself in recent British trials. It is driven by a slow-speed two-cylinder opposed horizontal motor.

At present the four-wheeled machine seems to be the favourite, both as regards the number of makes and the criticisms of observers at trials. Some makers favour motor-car-type engines for their machines, and others the slow-speed heavy-duty opposed horizontal motor. Of the latter the best known in New Zealand is the Avery, which has also given good results. The Mogul and Titan also have been sold to a number of satisfied users. Both of these are driven by slow-speed horizontal engines, with a single cylinder only in the smaller sizes.

TRIALS.

It has been suggested that the Government should hold trials or demonstrations, but the arguments put forth in their favour have not been convincing. At all these trials the machines are run by experts and not by farm hands who have little or no engine knowledge, consequently the results cannot be compared with those obtainable under ordinary conditions. With a large number of entries it is impossible to select areas that will give similar conditions to all. It has often been noticed that even in a small paddock a tractor will work quite indifferently at some particular spots. What, therefore,

is the use of comparisons under these conditions? Results would be only misleading. Again, is each competitor to use his own plough? If so, it comes down to a trial of ploughs, not tractors; and if one plough is used, then some machines will be overloaded while others will not be able to exert their full power. Any trial which sets out to show which is the "best machine" is doomed to failure. However, there are plenty of points that might be inquired into, and the writer is of opinion that the Department could well turn its attention to experimenting with various attachments, &c., for different soils.

SCOPE OF WORK.

It is not claimed that tractors will eliminate all horse-work on farms, but there is no doubt that on the average they can replace at least 80 per cent. of it. Mr. M. Saunderson, one of the partners of Saunderson and Mills (Limited), of Bedford, England, makers of the Universal tractor, purchased a heavy-clay-land farm of 240 acres in Bedfordshire, which is being worked solely by motor-power as an experiment. For twelve months motors have done all the ploughing, seeding, harrowing, and rolling, carted all the produce and manure, and cut, tedded, and raked the hay. Not a single horse was used. A great saving of time may be effected by the use of tractors, because not only can they do their work in better shape and time than horses, but if necessary (provided the machine is powerful enough) they can haul two or more implements together, and thus perform several operations at the same time. For instance, ploughs and harrows, or disks, drills, and drags, or two binders, have been placed on the one hitch. Let it be understood that coupling up more than one implement to a tractor is not quite as simple as it looks, and farmers would be well advised to consult their implement-makers or agents in regard to this matter. Most tractor-makers supply special hitches for coupling any number of binders. It is claimed that these hitches not only steer the implements automatically, so that they cut an even swath, but turn them at the corners at the correct angle. In addition to the ordinary work of cultivating, seeding, and harvesting, the machines give good results at stationary work, such as chaffcutting, threshing, grinding, &c.

As a rule, tractors are not very suitable for road haulage. It is true that they are used for this purpose, but their slow speed (three miles per hour on top gear in most cases) rather puts them out of court Moreover, the majority of makes are not provided with springs, and consequently would soon knock themselves to pieces on poor roads. True, some manufacturers provide a third speed as high as twelve miles per hour, with axles on springs, but this requires extra engine-power; and on account of the increased cost it would pay farmers to purchase a cheap motor-truck, which can be placed on the

road at any time, and leave the tractor to perform the more heavy farm-work.

SIZE AND POWER, ETC.

It is desirable that intending purchasers should understand the terms used in connection with the size and power of tractors. Sizes are usually expressed in a compound term, such as 8–16 or 12–25 h.p. The latter figures in the term refer to the horse-power delivered at the belt-pulley of the machine; and purchasers should insist on getting an engine the vendors of which will guarantee that the belt-power is brake or actual power. Any other power-guarantee is useless and misleading. The former figures refer to the equivalent animal horse-power in actual work performed at the draw-bar. Thus an 8–16 h.p. tractor should do the same work as eight draught horses week in and week out, and deliver for stationary work 16 b.h.p., or the equivalent of raising sixteen times 33,000 lb. 1 ft. high in one minute. It must be remembered that an oil-engine is not capable of delivering power much above the rated capacity for which it is designed, while for a brief period horses can and do exert power over and above that which is usually expected of them. They are not capable of sustaining this effort day in and day out, but a properly designed tractor will give its rated power at all times while in good order. A well designed and constructed machine should deliver 50 per cent. of its brake horse-power at the draw-bar.

For New Zealand conditions it would appear that the 8–16 h.p. machine is the size most suitable for comparatively small farms, but to those who can afford it one a little more powerful, say, 12–25 h.p., is recommended. The extra power will enable another furrow to be ploughed, and leave some in excess for emergencies. Owing to the shortage and high price of benzine only machines that will burn one of the cheaper fuels, such as kerosene or distillate (preferably the former, as distillate is also scarce), should be procured. Farmers should be wary of tractors driven by high-speed motor-car engines with some attachment said to burn kerosene, but which usually fails in its duty. Owing to its slow rate of combustion kerosene can only be efficiently used in a slow-running heavy-duty type of engine, with a crank-speed of about six hundred revolutions or less per minute. Tractors have heavy work to perform, consequently they should be solidly and well built, and anything of the motor-car type eliminated. At the same time, a single-cylinder machine is not favoured, but there are a number manufactured that are driven by slow-speed, multi-cylinder, heavy-duty engines. An efficient radiator for cooling the circulating water is an essential feature, and it is to be regretted that machines with nothing more than motor-car radiators are being made; they cannot be efficient for the work they have to perform.

Farmers are warned not to purchase a tractor that is made by a firm which buys its engines from some motor-car-engine maker and its radiators from a motor-car-radiator maker. Compared with a tractor, a motor-car is as a racehorse to a draught horse, and no farmer would think of putting a team of racehorses to plough. A tractor is best designed and manufactured throughout by the same company, with the exception of the magneto, roller bearings, and other special features, which are delicate pieces of mechanism only made by experts.

It is to be regretted that there is such an extreme shortage of tractors on the New Zealand market at present (British makes are unprocurable just now owing to the great demand at Home), for they are undoubtedly an efficient help to the farmer, and he need have no hesitation in purchasing a suitable type if he has work for it. In the great commercial struggle that is to come after the war any factor that will help our farmers to play their part should be sought after. It would certainly be an advantage if shipping-space could be made available at fixed freight-rates, so as to enable farmers to procure tractors at something like a fair price.

TRACTORS REPRESENTED IN NEW ZEALAND.

The following is an approximate list of the various tractors that are at present represented in New Zealand, together with particulars of power, &c., so far as available:—

Tractor.	Representative.
	British.
Martin Motor-plough	Curry, Eliott, and Co., Auckland.
Daimler, 50–105 h.p.	G. Henning, Auckland.
Marshall's, 16–32 h.p	Andrews and Beaven (Limited), Christchurch.
Ruston and Proctor (h.p. not quoted)	Alex. Storrie (Limited), Invercargill.
	American.
Samson Sieve Grip, 6–12, 10–20 h.p.	T. and S. Morrin (Limited), Auckland (and sub-agents).
Mogul, 8–16, 12–25 h.p. ..	International Harvester Company of New Zealand (Limited), Christchurch (and sub-agents).
Titan, 10–20, 12–25, 15–30, 22–45 h.p.	
Avery, 5–10, 8–16, 12–25, 18–36, 25–50, 40–80 h.p.	A. Hatrick and Co. (Limited), Wellington.
Waterloo Boy, 12–25 h.p. ..	Donald and Sons (Limited), Masterton.
Fairbanks Morse, 15–25, 30–60 h.p.	
Cleveland (h.p. not quoted) ..	W. J. P. McCulloch, Dunedin.
Lawson (h.p not quoted) ..	,, ,,
Bull, 10–20 h.p.	W. J. Hunte, Wellington.
Sandusky, 10–20, 15–35 h.p. ..	Inglis Bros. and Co. (Limited), Wellington.
Emerson, 12–20 h.p. and up ..	Emerson Company (Australasia), Limited (sub-agents, New Zealand).
Marlin "Universal," 12–25 h.p...	J. MacAlister (Limited), Invercargill.
	Australian.
Imperial, 6 15, 12 25 h.p. ..	Richardson and McCabe (Limited), Wellington.

APIARY EXPERIMENTS AT RUAKURA.

THE "DEADMAN" SUPER CLEANER SYSTEM.

A. B. TRYTHALL, Apiarist, Ruakura Farm of Instruction.

[Mr. Trythall's note which follows may be regarded as a progress report in connection with a policy of experimental and demonstrational work instituted by the Horticulture Division of the Department at the Ruakura Apiary. Other matters under investigation include daily weight and daily temperatures of hives, advantages or otherwise of various makes of hives, various capping-melters, thick honey, &c. It is proposed to publish in the *Journal* records of these investigations as completed or definitely advanced.]

ONE of the best experiments carried out at the Ruakura Apiary during the past year has been the testing of a drip-comb super cleaner as originally used by Mr. G. A. Deadman, of Merlin, Ontario, a description of which appeared in the *American Bee Journal* for October, 1916.

The cleaning-up of wet combs from the extractor, especially after the last extracting, when the honey-flow is practically over, has always been a troublesome process, and often fraught with the danger of setting up "robbing" in the apiary. The usual practice is to return the supers containing such combs to the hives to be cleaned up. In large apiaries this often causes undue excitement, especially if attempted (which it never should be) before sundown, and many are the cases of robbing and subsequent loss of colonies which have occurred through this cause. Then, again, there is little benefit derived from the small amount of honey usually present in the combs, since it is divided among so many colonies that the extra gorging which the bees do nearly consumes the available honey.

The Deadman device, as shown in the illustration, consists of a large stand or floor-board, capable of holding one hive of bees (which is placed in the middle at the front) and five piles of supers. The floor-board is so constructed as to allow free communication between each stack of supers and the central hive, but the only means of entrance from outside is the ordinary opening of the central hive.

The five piles of supers can be tiered up to any height required. Care, however, must be taken to see that the joints and roofs are all tight-fitting. They will then be quite safe from attacks from robber-bees, the only entrance, as already stated, being through the centre hive. The entrance shutters can be reduced to a minimum, which

the bees will easily defend. As the piles of supers are at the sides of the centre instead of on the top, the bees remove the honey as soon as possible, and if the colony is short of stores it soon makes the best of its opportunities.

If there are many supers to clean up it is advisable to place surplus accommodation on the hive. By this means last year we secured at Ruakura a good number of beautifully filled and capped sections from our drip-combs.

THE "DEADMAN" SUPER CLEANER IN OPERATION AT THE RUAKURA APIARY.

Another advantage can be claimed for this system. Supposing that foul-brood has recently developed in one or more hives of an apiary and has escaped detection when the honey supers were removed, it is quite likely, under the old plan of cleaning up the drip-combs, for the disease to be conveyed to a number of other hives throughout the apiary. On the other hand, by the use of the Deadman device it is only likely to be transmitted to the one hive at most, and if that hive shows a clean bill of health the following spring it

speaks well for the general state of the apiary, even though it may not be absolute proof that no disease exists.

This appliance was on view at Ruakura on the field-day held in connection with the Waikato Beekeepers' Association in February, and I have since heard that two of the members at least made and tested the device shortly after getting back to their own apiaries. One has since reported that he has found it a great boon, and is highly delighted with it.

THE INFLUENCE OF BEES ON FRUIT CROPS.

F. A. JACOBSEN, Apiary Instructor, Palmerston North.

THOSE who cultivate the soil must, to be successful, take advantage of the various forces of nature which are likely to help them in their work. In regard to fruitgrowing it must be remembered that the whole industry stands on an artificial foundation. Fruit-trees such as we cultivate rarely exist in a natural state. Rarely do fruit-trees growing under natural or wild conditions produce such a mass of blossom as is given by our artificially conditioned trees. Nature evolved a less prolific tree, and planted it where conditions favoured its growth. We plant the tree where we wish, and all the conditions may not be favourable to its well-doing. One important phase of fruit-production is fertilization of the flowers. The question of self-sterility or otherwise as existing in fruit-trees is a much-debated point, and it is not necessary to discuss it here, because even supposing all varieties of fruits to be capable of fertilizing themselves with their own pollen, there must still be extraneous aid or it will be but imperfectly done.

The pollination of flowers is effected in many ways. Various insects perform a large part of the work, and wind also assists. It is to be remembered that in spite of nature's provisions wild trees do not produce their fruit with certainty year after year. It may be that the weather is too damp to allow of the customary free dispersal of pollen by wind, and were that so it would naturally follow that insects also would be less abundant. Now, an orchardist expects a crop of fruit every year, therefore he should call to his aid whatever will contribute to the perfect fertilization of the flowers.

Pollination may take place in two different ways, namely: (1) Cross-pollination—when the pollen of a flower is distributed to the pistil of another flower; (2) self-pollination—when the pollen of a flower is distributed to the pistil of the same flower.

It has been found with many plants that cross-pollination produces a better crop of seeds, and that the plants produced from these seeds are stronger and better able to survive in the struggle for existence. The importance of cross-pollination to many plants has produced many contrivances to prevent self-pollination and to enable the far more successful cross-pollination to take place. For instance, the stamens and carpels may be produced in different flowers, thus necessitating the pollen being carried from flower to flower, or, although the stamens and carpels are produced in the same flower, they may mature at different times.

Every horticulturist has, or should have, recognized the importance of perfect pollination of the blossoms of fruit-trees and fruit-bearing plants for securing a full and well-developed crop of fruit. It has been proved that certain fruit varieties when grown in isolated blocks will not have satisfactory results, for possibly their blossoms are self-sterile, or, in other terms, the pollen of the blossoms will not fertilize the latter; and it is a matter of fact that if the blossom is not properly pollinated the fruit will not set, or, if attempting to do so, will produce only an imperfect specimen.

The apple is called by botanists a pseudo-syncarpous fruit, because it may be regarded as five fruits gathered into a unit by an envelope formed by a development of the calyx. If the apple be cut across we see five compartments in the core, each one of which should contain pips or seeds. The bloom which preceded the fruit had five stigmas, each of which communicated with its separate compartment and required an independent fertilization. Bees working on the blossoms would get their bodies covered with pollen, and, flitting to a blossom whose stigma had reached a receptive condition, would bring about fertilization. It would, however, frequently happen that only three or four of the stigmata would be pollinated, and in this case an imperfect apple would be produced. Trees agitated by the wind drop a number of their fruits, which are known as "windfalls," but the actual cause of this dropping is in by far the largest number of instances defective fertilization.

We all understand that a self-fertile blossom is one that is capable of pollinating itself. Self-fertility is, I believe, a characteristic of certain varieties, a condition which obtains in many different species of fruit trees and plants, but it may vary in certain localities and under different conditions. It has further been shown that cross-pollination of one variety with another gives better results than when the blossoms are fertilized with their own pollen. Cross-pollination not only increases the size of the fruit, but also increases the quantity of fruit set on a given tree. A self-sterile blossom is not necessarily always destitute of pollen or fertilizing-element, neither is it true that a variety being self-sterile is incapable of fertilizing another variety. Two self-sterile varieties may pollinate each other, providing they bloom at the same time. There has been evidence to indicate that the anthers of individual trees of the same variety contain much more fertilizing-element than do others of the same sort. For example, I have noticed that trees of the same variety under the same conditions vary greatly in the regularity of bearing, as well as in the amount of

fruit produced from year to year, showing that some trees are more susceptible of perfect pollination than others of the same kind.

Numerous experiments in older countries have been made to determine the difference in yield and the perfection of fruit in orchards that have been somewhat isolated from the means usually employed in bringing about perfect pollination, as compared with other orchards that have had free access to the various agencies that are applied in the fertilizing of blossoms, and the latter conditions have invariably resulted in an increased yield and the better formation of the fruit produced.

Among the various agencies by which the pollination of blossoms is affected may be mentioned artificial or hand fertilization, the atmosphere in motion or wind, and the numerous insects that frequent the blossoms in search of pollen and nectar. But of all the means employed in this essential and delicate work among the entomophilous flowers no doubt the honey-bee is the most potent factor of all. Mr. Cecil Hooper, of the Linnean Society, London, who investigated this subject, wrote as follows regarding his observations: "Out of nearly three thousand insects observed this spring visiting the blossoms of various fruit-trees and bushes, 88 per cent. were hive-bees, 5½ per cent. humble and other wild bees, and 6½ per cent. flies, ants, beetles, wasps, and other insects; but the latter group have no fluffy bodies for carrying and transferring pollen, and chiefly amuse themselves eating the pollen, and are not therefore proportionately as useful as the hive and wild bees."

I have many times noticed that where honey-bees in great numbers are fairly covering the blossoms of the apple, plum, and cherry, other insects are not so active, as possibly the season is yet too early for them. At the time the trees are in full bloom every prosperous colony of bees contains thousands of young larvæ which must be provided for by the old inmates of the hive. The principal part of the pollen and nectar gathered at this time is devoted to the feeding of the emerging brood and to stimulating the queen in her special mission of egg-production. And yet, under favourable conditions, there have been instances when bees have been known to store considerable quantities of honey from fruit-blossoms, especially from the blossoms of apple-trees. It may be remarked here that bees are particularly essential in cherry-orchards.

The action of fertilization by bees is not deliberate, but in their work upon the blossoms in search of pollen and nectar their hairy abdomens become loaded with tiny balls of dust pollen, which is all the while being shaken off and distributed upon the pistils of bisexual blossoms, completing a most perfect fructification. It is true that flowers are absolutely necessary to bees as the source of their food, but, on the other hand, bees are very necessary to most flowers so that their perpetuation may be secured.

It is sometimes alleged that bees injure fruit, but nothing can be more fallacious than this idea. When the skin of fruit or grapes has already been punctured they will suck the juices, as is only natural; but to say they bite these holes themselves is ridiculous, as such a thing has been proved impossible scores of times.

Commercial jam-makers, during the preserving season when bees perhaps steal a little of the juices not found in the waste-tub, cause the destruction of thousands of these industrious workers by pouring boiling water over them. People do not usually understand that by carrying such "slaughter of the innocents" too far and with too high a hand they would have very little fruit to preserve.

It may be said that butterflies, moths, beetles, and other members of the insect world fertilize the fruit crops as well as the bee family. This is true to some extent, but they leave behind them whole armies —well-drilled armies—of caterpillars and maggots. These destroy the very fruit their parents fertilized, defoliate the trees, cause disease, and, if not held in check, the destruction of the orchard. This cannot be said of bees. Butterflies fly from tree to tree and orchard to orchard, laying a few eggs here and there. It is difficult to introduce them into a district and still more difficult to confine them to a given area, but when once introduced the greatest difficulty of all is to exterminate them. Insect fertilizers, apart from the bees, are nearly all solitary and homeless wanderers, and it is a work of patience and labour to mitigate their ravages.

On the other hand, bees are social, are domestic, are under control, and can be increased or diminished according to requirements. The proximity of an apiary to an orchard is a benefit so prominent and outstanding that in the fruit season no visitor fails to recognize and see the handiwork of the bee. Not only do orchard-trees accept as their due the visits of the bees, but also the numerous small crops often grown between the rows receive to no less an extent the benefit of successful pollination. This may be said particularly of strawberries.

An experiment illustrating the enormous benefit fruitgrowers derive from bees, an account of which was published in the University of California Bulletin No. 274, December, 1916, was conducted in the Santa Clara Valley, California. The trees under experiment were French and Imperial prunes. Two huge bee-proof tents were constructed in each case over a French and Imperial prune-tree, and at the right time a strong colony of bees was put in one tent, the other remaining without any means of fertilization except wind or an occasional minute insect. In each case a number of blossoms was counted and marked, and afterwards recounted to ascertain the number of fruits set. The results in the case of the French-prune trees are as follows:—

—	Number of Blossoms in count, 11th April, 1916.	Number of Fruits matured, 1st August, 1916.	Per Cent.
French-prune tree under tent with bees ..	1,069	193	18·05
French-prune tree under tent from which bees were excluded	1,058	11	1·04
French prunes, average orchard set ..	9,991	359	3·59

It will thus be seen that nearly six times more fruit set on the tree around which the bees were confined than the average orchard

set, and eighteen times more than on the tree from which insect fertilizing agents were excluded. In each case an Imperial-prune tree was confined with the French variety for purposes of cross-pollination.

The value of the bees to the orchardist has thus been proven, but the value of the orchard to the bees, or the owner of the bees, must be further discussed. By the apiarist the orchard is not looked upon with that favour that might be expected when viewing one in full bloom in the spring. Commercial orchards are now planted with few varieties, and the blossoming-period is consequently short. For the greater part of the year an orchard provides exceedingly bad bee-forage, except in those orchards that are neglected and are allowed to become infested with such honey-producing weeds as yarr, smart-weed, shepherd's purse, thistles, &c. For obvious reasons a beekeeper would not select a fruitgrowing district for commercial beekeeping purposes, but rather a dairying district where clover is in abundance. It therefore devolves upon the orchardist to supply the necessary agents for pollination. Apart from supplying forage for the bees, the growing of cover-crops between the trees is important in improving the fertility of the soil. But even this help is of small value to the beekeeper, because in most instances cover-crops require to be ploughed in before having completed flowering. Crimson clover and certain vetches, such as grass-peas, are suggested as useful honey-producing leguminous orchard cover-crops.

Many commercial orchardists in the United States have recognized the great importance of bees as pollinators, and it is customary for fruitgrowers to pay as high as 5 dollars per colony to beekeepers who are willing to bring their bees into the orchard during fruit-bloom. The beekeeper looks after the bees during the three or four weeks of fruit-bloom, and afterwards removes them to his permanent location, which is probably some miles away. This arrangement is becoming increasingly popular, and the orchardist considers that by renting colonies of bees on the above terms each season he is getting good value.

A factor that must eventually be taken into closer consideration when laying out new orchards is the planting of varieties that are most suited to fertilizing each other, thus securing to the bees the best opportunity of doing the maximum of good work. If some method of increasing the period during which bees may profitably work in orchards is not formulated, such areas must be ranked of little importance for honey-production, and as it is essential that bees be kept in or near orchards this would be very regrettable.

Hoeing of weeds in the mangel crop at Ruakura during the past season occupied a considerable amount of time and labour. With a view of reducing this work next season a red-clover paddock is being set aside for mangel-growing. A clean field to start with makes all the difference in this respect.

THE GRASS-LANDS OF NEW ZEALAND.

(Continued.)

A. H. COCKAYNE, Biologist.

COMPONENT SPECIES.

ALTHOUGH there are over three thousand species of grasses and many hundreds of species of clover, only between thirty and forty species of grasses and about ten species of clovers are sown in pasture mixtures throughout the world. Probably no country in the world uses regularly in the laying-down of pastures so many different species as does the New Zealand farmer. This is perhaps partly due to the fact that in New Zealand a very wide variety of soil-types are devoted to grass-production. Again, in primitive New Zealand there were no meadows, though natural pastures of an almost steppe-like character were abundant in the drier parts of both Islands.

The aim in New Zealand is to grass as well as possible every type of ground, irrespective of whether it is suitable or not for the more commonly used European grasses. In consequence a considerable diversity of species have been and are being used. Although it is safe to say that more species of grasses have been used in New Zealand than in any other single country, there are two that stand out as predominant. These are perennial rye-grass and cocksfoot. These two grasses are characteristic of nearly all sowings in New Zealand, but they are not necessarily characteristic of the older pastures in which they were sown. This fact has had a very great influence on the extended sowing of many other species of grasses, and will be fully discussed later on.

The following is a list of the main grasses and clovers that are used, with some particulars with regard to their seed :—

Name of Seed.	Number of Seeds per Pound.	Average Germination Percentage.	Bushel Weight.	Total Quantity used annually.	Produced locally.	Imported.
Grasses.						
			lb.	Tons.	Tons.	Tons.
Perennial rye-grass ..	250,000	85	30	8,000	7,000	1,000
Italian rye-grass	230,000	85	20–22	1,000	800	200
Western Wolths rye-grass ..	220,000	85	20	80	60	20
Cocksfoot	560,000	75	16–18	1,500	1,000	500
Crested dogstail	880,000	80	33	100	95	5
Meadow-fescue	240,000	88	24	20	..	20
Timothy	1,250,000	90	46	200	..	200
Meadow-foxtail	620,000	36	8	30	5	25
Chewings fescue	525,000	86	28	100	100	..

Name of Seed.	Number of Seeds per Pound.	Average Germination Per-centage.	Bushel Weight.	Total Quantity used annually.	Produced locally.	Imported.
Grasses—continued.						
			lb.	Tons.	Tons.	Tons.
Sheep's fescue	650,000	50	18	1	..	1
Poa trivialis	2,900,000	65	26	10	..	10
Poa nemoralis	2,580,000	40	17	½	..	½
Poa pratensis	2,400,000	50	..	100	..	100
Red-top	5,500,000	85	38	10	..	10
Fiorin	5,500,000	85	38	10	..	10
Waipu brown-top ..	5,500,000	60	..	5	5	..
Tall fescue	250,000	60	15	..	..	..
Danthonia pilosa	500,000	45	5	100	100	..
Danthonia semiannularis ..	1,000,000	45	3½	25	25	..
Tall oat-grass	155,000	45	13	..	..	..
Golden oat-grass	1,750,000	20	5	..	..	..
Paspalum	454,000	30	20	45	5	40
Hair-grass	600,000	..	..	..	..	..
Goose-grass	160,000	..	17	..	..	..
Phalaris bulbosa	400,000	45	46	..	..	..
Sweet vernal	700,000	46	9	½	..	½
N.Z. rice-grass	180,000	..	6	2	2	..
Prairie-grass	42,000	75	17	50	45	5
Ratstail	1,500,000	60	25	5	5	..
Yorkshire fog (shelled) ..	1,250,000	85	40	40	40	..
Clovers						
Red clover	240,000	90	65½	2,000	800	1,200
White clover	670,000	90	66	600	50	550
Alsike	630,000	90	66	75	..	75
Suckling-clover	1,000,000	80	66	20	..	..
English trefoil	300,000	75	66	15	..	15
Lotus hispidus	930,000	75	66	10	10	..
Lotus major	900,000	80	66	10	6	4

A great deal of hair-grass, goose-grass, fog, and sweet vernal is sown as impurities in seed-mixtures, and the quantities are not included in the above table. Tall oat, golden oat, tall fescue, and phalaris are so infrequently sown that the amount used annually is virtually nil. A great deal of suckling-clover, calculated at over 36 tons, is sown as an impurity in white clover. Certain other clovers, such as subterranean and strawberry, are occasionally sown. Clustered clover, scabrid clover, haresfoot-trefoil, and hop-trefoil are important over much grass-land, but are never intentionally sown.

GENERAL NOTES ON GRASSES AND CLOVERS.

Before proceeding to treat various special aspects of the grass-lands of New Zealand it will be well to record some general notes on grasses and clovers in relation to this country.

Perennial Rye-grass.—The most extensively used of any grass, about 8,000 tons annually being sown. The predominant position occupied by perennial rye-grass is due to the fact that it is the dominant grass-seed used in all rotation mixtures. Of the 8,000 tons, 6,000 is used

in the South Island and 2,000 in the North Island. The popularity of perennial rye-grass is due to the following reasons: (1) The seed is cheaper than that of any other grass; (2) it germinates freely under all except the most adverse circumstances; (3) it yields well on most arable land; (4) the herbage is well liked by all stock. The great advantages outweigh the bad features of perennial rye-grass, and as a rotation grass it will always occupy the premier position. Its main objections are two in number—firstly, it is permanent only on certain types of ground; and, secondly, when the flowering-culms develop they are rejected by stock, and very little herbage is produced till the following autumn, especially during a dry summer. In normal years sufficient seed is produced in the Dominion for local requirements, importations being made only when locally grown seed is in short supply.

Italian Rye-grass and Western Wolths.—About 1,000 tons of these grasses are used. They are the dominant elements in all temporary pastures, and are widely used as temporary ingredients in longer-duration grass-lands. The use of Italian is on the increase, and on rich land it is one of the most valuable of grasses. In temporary pastures, for the breaking-in of certain types of natural vegetation, both it and Western Wolths are invaluable. In normal years sufficient seed is produced locally to fulfil all requirements. During the past four years, however, large amounts of perennial and Italian rye-grass seed have been imported from Ireland.

Cocksfoot.—The most important constituent of nearly all long-rotation and permanent grass-land mixtures. About 1,500 tons are sown annually. The employment of cocksfoot—naturally a tussock grass—on purely sheep-country is one of the most remarkable features of New Zealand pastures. Its tussocky nature is obviated by close grazing, but this artificial restriction of its natural growth-form has led to numerous problems in devising cocksfoot-mixtures. When cocksfoot is almost pure in sheep-pasture the soil will not hold together properly, and many plants become pulled out during the winter, when the growth is slow. As a midsummer grass on all but the poorest soils cocksfoot is unrivalled. Heavy stocking in the spring prohibits flowering, with the result that good herbage-production occurs throughout the summer. With the exception of certain reclaimed swamp and rich river-silt pastures, cocksfoot pastures are all more likely to earn their full value without assistance from supplementary grass crops than are any others. Part of the seed is produced locally, but a great deal is now imported from Denmark.

Timothy.—Timothy rarely is used as the dominant ingredient in a mixture, but on nearly all long-rotation and permanent grass-land it is included. It requires a rich cool soil for its best development, but as the price is generally low it is often included in mixtures for soils where it is not suitable. On cattle-country timothy is especially valuable, but on purely sheep-country is temporary in its duration. Nearly all the seed used is imported from the United States.

Fine-leaved Fescues.—The only one of these that is now used extensively is Chewings fescue. At one time it was looked upon as valuable as a minor ingredient in general mixtures for long-rotation and permanent grass-land on poor dry soils. When sown, however, it often becomes dominant, and on poor soils danthonia has almost entirely

taken its place. On bad soils where there is a good rainfall it is valuable, and may become the dominant ingredient used. In former years Chewings fescue was used on soils well fitted for cocksfoot, but the practice is now abandoned. If allowed to get away the herbage is not relished by stock. Seed is all produced locally, and there is also an export trade.

Poa pratensis.—Used on permanent grass-land only. A valuable grass, whose use on moderately good soils is increasing. On certain types of rotation pasture *Poa pratensis*, even if not sown, becomes dominant when the duration of the pasture is extended. On arable land it is justly ranked as one of the worst of weeds. *Poa pratensis* is especially valuable on steep slopes. The mat-like growth avoids it being pulled up in the winter like cocksfoot. Nearly all the seed comes from the United States.

Poa trivialis.—This is a valuable grass on high-class, long-rotation, and permanent pasture, yielding well during the winter. Its presence naturally in pastures denotes that foxtail should be included in any lea of long duration. The seed is imported from central Europe.

Poa nemoralis.—Included only in certain grass-mixtures used in the King-country. Our knowledge of its economic value is limited. On fairly poor bush pumice country it has given splendid results when included in the ordinary cocksfoot-rye type of mixture.

Meadow-fescue.—Probably should be an important constituent in the ordinary cocksfoot-rye mixture for leas of long duration. It suffers badly from rust, but has the great advantage over rye-grass in yielding well during dry summers.

Crested Dogstail.—Included in nearly all leas of long duration except on those used purely for cattle. Although its yield is not so great as that of cocksfoot, rye-grass, and meadow-fescue, it is one of the most palatable grasses. One of its most noticeable features is that, although it is permanent and increases, it does not interfere with the proper development of the other constituents of the pasture. Its use has increased of late years. Nearly all the seed sown here now is locally grown.

Danthonia pilosa.—Next to rye and cocksfoot, the most important grass in New Zealand. Although it is not sown to the extent of either of the latter grasses, there are immense areas where the various types of bush-burn mixtures are now dominated by danthonia. The term "danthonia pasture" can be applied to several millions of acres of grass-land. Danthonia has numerous defects, but on the whole it can be looked upon as the most valuable grass for rough second- and third-class country that we possess. This grass will be dealt with more fully later. The seed is locally produced.

Danthonia semiannularis is also an important grass of poor lands, but does not occupy the important economic position of *Danthonia pilosa*.

Meadow-foxtail.—Probably the most nutritious of all grasses. It is suitable only for the richest types of land, and on such is often dominant. It has the great characteristic of having a very long blooming season, and therefore yields a long continuous supply of herbage. Nearly all the seed is imported, owing to the destruction of local seed by the foxtail-midge. On many reclaimed swamps it is the most important grass that is sown.

Prairie-grass.—Not used much at the present time. Its great winter-yielding capacity would render it one of the most valuable of grasses. However, it can be said that the proper management for its successful and profitable establishment has not been yet properly determined.

Agrostis.—All the species of agrostis can be looked upon as of poor feeding-value. They, however, are widely distributed, and are often very important constituents in pastures on poor soils. In certain localities they replace rye-grass pastures that are not broken up. With the exception of Waipu brown-top the seed is nearly all imported from America.

Ratstail.—An inferior grass of importance on danthonia country and rice-grass country in the North. All the seed used is locally grown.

Phalaris bulbosa.—At one time greatly boomed as a winter grass. It is still sown, but in a few years the practice will be abandoned. Its failure to hold in competition with other grasses makes it quite unsuitable in mixtures, and as a pure association phalaris has not given the results expected.

Microlaena stipoides (N.Z. Rice-grass).—Important on coastal danthonia country and coastal ratstail-danthonia country. The great difficulty of sowing the seed makes it unpopular.

Yorkshire Fog.—An important constituent of many pastures. It is only sown extensively on poor undrained swamp-land. In the conversion of peat swamps too poor to grow Italian rye-grass it is essential. It is also valuable as a transition association in the formation of certain types of permanent grass-land on very inferior land or land subject to invasion by certain types of native vegetation. The seed is a common impurity in many agricultural seeds, which well explains its wide distribution.

Paspalum.—This grass is being used more and more each year in the northern parts of New Zealand. It was fully discussed, including its use as a supplementary grass crop, in the last February *Journal*.

Golden Oat-grass and Tall Oat-grass.—Both these grasses are sown at times. They do not, however, form any important component of any of the grazed areas of New Zealand.

Festuca arundinacea.—A useless swamp grass that by being sown in the past has formed large pure associations. The endeavour at present is to replace it by more valuable grasses at the minimum of expenditure.

Goose-grass and Hair-grass.—Important weed-grasses on many types of pastures. They will be further discussed when dealing with rotation pastures. Sweet vernal may also be included in the same category as goose-grass.

Other Grasses.—There are many other grasses, such as *Poa annua, Glyceria fluitans,* and *Alopecurus geniculatus,* that are important, but as they are never sown they will only be mentioned when dealing with the classification of pastures.

Red Clover.—This is the standard clover of all types of pastures, especially those of short duration. It is occasionally sown as the dominant ingredient of the mixture. In these notes red clover and cow-grass are taken, for the sake of convenience, as being the same. About half the seed is imported from Europe.

White Clover.—The standard clover of all long-rotation and permanent pastures. Many soils are not suited for white clover, but it is rarely omitted from the mixture, except in country where there is an abundance of seed naturally in the ground.

Alsike.—Used on lands inclined to be wet and sour. It is a moot point whether alsike is an economic proposition as compared with red clover.

Trefoil.—Used in mixtures in sandy soils. Its use is not increasing.

Suckling-clover.—The most important clover in New Zealand. As already indicated, it is rarely sown *per se*, but is an integral constituent of nearly all types of pastures except those on the heaviest of swamp soils.

Birdsfoot Trefoils.—Two species are important—namely, *Lotus major* and *Lotus hispidus*, the latter generally known as *Lotus angustissimus*. These two clovers can thrive in soils that are too sour for the growth of any other clover, and are therefore of great value under certain conditions.

Other Clovers.—There are a number of other clovers that are important on grass-land, but are rarely if ever sown. The main species are hop-trefoil, clustered clover, strawberry-clover, and subterranean clover.

In these short notes no reference is made to the main natural constituents of the unimproved grass-lands. As these, again, are not sown the associations themselves will be mentioned when treating the subject of classification.

Although the plants used in the formation of grass-land consist almost entirely of grasses and clovers, there are occasionally sown in pasture mixtures a few plants other than those belonging to the natural orders of Graminae and Leguminosae, such as yarrow, chicory, sheep's burnet, and sheep's parsley.

PURE PASTURES AND MIXED PASTURES.

By the term "pure pasture" is meant grass-land in which one particular grass is dominant and occupies virtually the whole of the ground during the entire year. A modification of pure pastures is where the pasture consists of several species, all abundant, but each species generally occupying ground to the more or less exclusion of the rest. Such may be termed "mixed pure association pastures." These in turn merge into true mixed pastures, where the various species comprising the turf are mingled together, and no one particular species occupies large areas to the exclusion of the rest. Nearly all the grasses used in pasture-formation may exist as pure pastures or mixed pure associations, but in general such pastures are confined either to certain special grasses grown for some particular purpose, or to those grasses that may be classed second- and third-class ones. What are termed the best European grasses generally comprise the mixed pastures.

Really, however, soil and climate are the factors that determine whether pure associations or mixed pastures will be produced. It can

be laid down as a general rule that the more inferior a soil may be the more likelihood there is of a pure pasture being finally produced, irrespective of whatever mixture may be used. On really high-class soil, in good physical condition, the conditions are generally equally favourable for the growth of numerous species, and they rapidly become very intimately intermingled when mixtures are sown. On very poor ground, or where there are some very special soil or climatic factors in operation, the conditions are generally more suited to one particular grass than another, and pure pastures are the rule.

Temporary and rotation pastures have really to be considered separately when dealing with pure and mixed pastures. Where the pastures are of short duration, grass-land can be greatly influenced temporarily by mixture variations. This does not occur to the same extent in pastures that are laid down for many years—that is, short-rotation grass-land of any desired type, irrespective to a large extent of soil factors, is governed by the mixture used, and gras es unsuited for permanent occupation can be established successfully for short periods. With permanent grass-land, however, the case is very different, and the soil and climatic factors are the deciding causes of what succession will take place before the final equilibrium in the struggle between the different species is arrived at.

In Europe it is the custom to aim at the production of mixed permanent pastures, and this also is the rule in New Zealand. In America it is considered that the most suitable species for the respective ground is the one that should be mainly sown, and pure pastures are the rule. Provided they can be produced in a stable form, mixed pastures offer great advantages over pure ones in the majority of instances. These advantages can be summarized as follows: (1) They offer a variety of feed; (2) owing to the growth-period of various grasses differing, mixed pastures yield a better seasonal supply of herbage than do pure ones; (3) temporary unfavourable conditions are less likely to restrict the herbage produced; (4) mixed pastures are appropriate to a greater variety of live-stock than are pure ones; (5) many grasses and clovers are not suitable for the formation of pure associations, but only show their best development when mixed with other species.

In laying down permanent pastures in New Zealand on high-class land it is assumed that the final components of the pastures will agree fairly closely with the mixture used, leaving out of consideration the temporary and semi-temporary elements. On second- and third-class land, and where very special conditions are experienced, mixed-pasture mixtures are still the rule. In them a good percentage of the seed is composed of those elements that are expected to be permanent, and finally form either a pure or a pure association pas-

ture. Besides this, however, a variety of grasses is also sown to act in three ways: Firstly, to produce a good type of succession or rotation type of pasture until the final components are established; secondly, to provide plenty of feed in the early years of the pasture, so that stocking can be regulated satisfactorily; and, thirdly, to cover the entire ground rapidly. In using a mixture of grasses and clovers with varying growth-forms the surface of the soil can be, in general, more rapidly and permanently covered, thus excluding the development of foreign growth more readily than when only one or two species are used.

On poor ground, and on ground subject to peculiar conditions, the effort is always made to establish a type of pasture just a little bit better than the ground actually warrants. In the early years of establishment, before equilibrium is attained, foreign growth—in reality more suitable for the ground than the plants actually sown—is liable to gain possession. Provided the ground is kept closely covered with plants from the sowing onwards, the likelihood of undesirable vegetation, such as piripiri (hutiwai), fern, manuka, &c., gaining the ascendency is reduced. As the permanent desired elements are generally slow to establish, they are, on poor ground, generally sown with what is in effect a rotation mixture. Periodical heavy stocking and variation in the type of stock used are factors that largely influence the suppression and exclusion of undesirable vegetation. These factors, in contradistinction to those of the soil or climate, are controllable. Thus on poor land the effort is made to produce a mixed pasture that may, under favourable conditions, remain mixed or gradually change into a pure or pure associations pasture, the stocking-factor being used as a means, on one hand, of thickening out the turf by trampling and consolidation, and at the same time acting as a check to the entrance of undesired vegetation.

Temporary and short-rotation pastures often are virtually pure ones of rye-grass. This, however, is not due to pure pastures being best for the purpose, but because there is not a wide range of grasses that give their maximum yield during the first year or two after sowing. The question of temporary and short-rotation pastures will be dealt with later.

There is, however, a type of pasture that fulfils a very important position even on the very highest type of land. This class of pasture may be termed the special-purpose permanent pure pasture, or special pasture. At various times during the year the ordinary pastures are not sufficiently productive to supply all requirements. To fill in these periods special supplementary grass crops have to be grown. These are generally termed summer or winter forage crops, depending on the time of the year at which they are utilized, and

are generally of a summer or winter annual character, requiring to be sown each year. There are, however, two grasses which when formed into pure pastures act as summer and winter annual forage crops respectively. As they are permanent, or at least last a good number of years, their expense is not great when contrasted with ordinary green annual forage crops. These plants are paspalum and prairie-grass. The first takes the place of a summer annual, and the latter that of a winter annual. Pastures of these plants sown pure remain pure associations for many years, provided the ground on which they are grown is suitable for their proper development. Certain types of temporary grass-land (mixed grasses and clovers) often act as supplementary pastures.

In many instances, during the development of a pasture a pure type may change by successional stages. This is generally due to a change in the soil factors, and may lead to the production of a mixed pasture, or to the possibility of producing mixed pastures. Many swamp pastures have originated in this way. In other cases sown mixed pastures may gradually undergo profound modifications, and finally the association formed may have no resemblance whatever in constituents to the mixtures originally sown. These changes that occur in pastures are known as successions, and their study is probably the most interesting of any phase of pasture investigation. A complete knowledge of the factors affecting succession would have very far-reaching effects on our management of grass-land, but up to the present they are in many cases quite unknown. Some of the more noticeable examples of grass successions will be touched on later when dealing with the subject of surface-sown grass-lands.

VARIATION IN FEEDING-VALUE AND YIELD AND PALATABILITY.

It can be shown from chemical analysis that there is considerable variation in the nutritive value of various pasture plants—in other words, the earning-power, in terms of live-stock products, is greater with certain species than with others. It might be argued from this that special attention should be given to the nutritive value when laying down land in any type of pasture. Much stress has been laid upon this point by many investigators, and details of the comparative value of nutritive quality is often a favourite theme of the farmer himself. There are, however, two other factors of such great importance that the chemical side of the question can be almost ignored until such time as these major considerations have been accurately studied. The two factors are: comparative yield under the same conditions, and actual palatability under the same conditions.

Before dealing with these matters it may be well to point out that comparative nutritive value is of very little moment on soils capable of producing only low-yielding pasture, but gradually becomes increasingly important with an increase in the grass-yielding capability of the soil. Thus, for example, on the poorest type of pasture in New Zealand, supporting, say, one sheep to 5 acres, and yielding 16 cwt. of grass per annum, a difference of 20 per cent. in the nutritive value of the grass means only an increase in earning-value (1½ cwt. at 4s. per ton) of less than 4d. per acre. On 28-ton grass-land a 20-per-cent. increase in nutritive value means an equivalent increase of nearly 3 tons, or, roughly, 12s. per acre. This is, of course, a very appreciable amount, and pasture on such country should always have the nutritive value of the grasses used carefully considered, in addition to any yield and palatability consideration.

It can, however, be laid down as an axiom that on all country where the carrying-capacity at any period of the year is less than two sheep per acre no consideration need be given to the nutritive quality, but every consideration has to be given to comparative yield and palatability. Indeed, for all practical purposes palatability can be used to signify good nutritive quality. Practice shows that this statement is correct. The species comprising any type of high-class pasture are nearly always the same and few in number, and all come under the category of highly nutritive grasses or clovers. On the other hand, on land of low-yielding character the number of species that comprise the vegetation may be extremely numerous, but very little consideration is given to comparative nutritive value. Again, many grasses vary considerably in nutritive quality at different periods of their growth, but in general this is of no moment, except when the nutritious and palatable stages are in coincidence.

Variations in palatability during various stages of growth are, however, of prime importance. Nearly all the poorer grasses, such as fiorin, Chewings fescue, danthonia, bay-grass, and such a clover as *Lotus major*, are relished by stock in their early stages. Such grasses and clovers when they "get away," as it is termed, are often quite unpalatable, and a great deal of their annual yield is wasted through not being eaten. Provision of extra supplementary feed to tide over the low-yielding periods of such grasses is, of course, the obvious course to adopt. But, unfortunately, their full earning-power is not sufficient to justify the great cost of supplementary feed, and it is considered better to actually lose the value of much of the herbage produced. Fiorin, Chewings fescue, and danthonia pastures are excellent examples. As soon as flowering commences their palatability drops enormously, but it apparently does not pay to have sufficient extra feed to keep enough stock to keep pastures eaten down.

Palatability is probably one of the most important subjects underlying the systematic study of pastures. Unfortunately, our knowledge of it is extremely scanty, and much that we do possess is personal and not scientific in its derivation. It is also connected with one of the most important practical considerations underlying pasture-formation —namely, the effect of using mixtures consisting of plants of varying palatability.

It can be stated as a general law that the unpalatable species in a pasture are more likely to obtain general possession of the ground than are the palatable ones. This is in many cases due to the most relished species being unable to seed, while those rejected generally seed abundantly. Extremely palatable plants in mixed grass-land are, indeed, very liable to be eaten out entirely in a short space of time, and the harder the conditions are for grass-development the faster will this be done. A striking example is seen in the red-top–cocksfoot mixtures used in pumice country. Often within two years the cocksfoot is completely eaten out, and only the red-top remains. On really high-class grass-land the presence of unpalatable species has not the same effect, as on such pasture the grass sole is so thick that there is generally no room for a great deal of natural germination to occur.

Depending on the thickness of the sole, grass-land is divided into two different kinds—those known as closed associations and those known as open associations. In the former the ground is completely covered with plants, while in the latter comparatively open spaces may occur. As a general rule, closed associations are what are termed stable, and are not likely to alter much from year to year.

(To be continued.)

CONTROL OF BROWN-ROT.

EXPERIMENTS IN PROGRESS.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

BROWN-ROT remains a serious menace, particularly to the stone-fruit grower. Owing to the rapidity with which the disease has spread throughout the country during the past three years there are few of our fruitgrowing localities where its appearance is not only too well known. Articles have already appeared in the *Journal* describing brown-rot in detail in practically all its phases. Publications from other countries, particularly America, where the disease has been known for many years, have also been collected and studied with the hope of gaining information that would assist in formulating its control.

With the same object in view experiments have been carried out during the past two years at the Department's horticultural stations, and also in co-operation with fruitgrowers and fruitgrowers' associations in different districts. Following these notes will be found a report on some of the experiments carried out during the past season at the Arataki Horticultural Station. Reports on all the other experiments undertaken are not yet to hand, and it is therefore impossible to give the results in detail at present.* However, sufficient information has been received on which to base an opinion, and this opinion, unfortunately, is far from being highly favourable to immediate success. Although the experiments undertaken have failed to indicate a reliable remedy for the control of the disease, a considerable amount of what may prove to be useful information has been gathered, and it will require at least another season to prove whether these experiments were carried out on right lines or not.

The plan on which the experiments in question were conducted throughout was exactly similar to that reported from Arataki, and included autumn and early spring spraying with the winter formula of the leading fungicides, followed by three and four sprayings during the early summer with the same mixtures at a reduced strength. Thorough cultivation of the soil at different periods formed part of the scheme but, unfortunately, the excessively wet weather during the autumn, winter, and spring precluded this work being at all properly attended to. This, and the very fact that the excessive wet was

* A valuable report on the experiments carried out at Henderson, Auckland, has since been received from the Orchard Instructor for the district (Mr. J. W. Collard), and will be published, together with a further Arataki report, in next month's *Journal*.

highly favourable to the disease, placed the experiments at a very decided disadvantage.

The previous indications in favour of summer spraying for the control of brown-rot have not been confirmed. In some instances the summer fungicides appeared to be of value, but on the whole the weight of evidence was rather against than in favour of summer spraying. This, however, cannot be taken as definite, as there were several factors applying that must be taken into consideration before a definite pronouncement can be made. These were as follows:—

(1.) Owing to the abnormal amount of rain the past three seasons were highly favourable to the development and spread of brown-rot, with the result that practically every orchard in the districts where the experiments were carried out was permeated with the spores of the disease.

(2.) As already mentioned, the state of the soil during the autumn, winter, and spring was such that it was practically impossible to thoroughly clean the orchards or to treat the soil in that manner so highly essential for the control of fungus diseases—that is, by turning in with the plough all dead leaves, surface soil, &c.

(3.) As a result of the last-mentioned condition and the frequent showers during the early summer the spores of the disease were too numerous to be kept in check with the weak summer fungicides used.

Arrangements have been made to repeat last season's experiments on similar lines, with, it is hoped, considerable improvement in the treatment of the soil. Additional experiments are also being arranged for in other fruit districts, and fruitgrowers' associations are invited to co-operate with the Department—which will pay all the necessary expenses — in extending the range of experiments with a view to finding a reliable remedy for the disease.

In the meantime, for general practice, fruitgrowers are strongly advised to take drastic action with a view of controlling brown-rot during the dormant season and after, according to directions given in the monthly orchard notes of this issue of the *Journal*.

BROWN-ROT EXPERIMENTS AT ARATAKI.

T. E. RODDA, Manager, Arataki Horticultural Station.

1. SPRAYING-TEST ON PEACHES AND NECTARINES.

An experiment was carried out at Arataki Horticultural Station during the fruiting season just past to ascertain if the brown-rot disease on peaches can be successfully controlled by spraying with the various compounds used in general orchard practice for the control of fungus diseases. It is regrettable to have to report, however, that a reliable

remedy, or a course of treatment that can be guaranteed to give positive results during a phenomenally moist and humid season, was not discovered.

A block of 252 trees of peaches and twenty-one trees of nectarines was selected for the purpose of the experiment. The peaches were plotted off into thirty-six rows of seven trees apiece, and the nectarine section into seven rows of three trees apiece. The following plan will illustrate how the trees were treated during the dormant and growing periods :—

NOTE.—The letter "A" before the numbers of the rows denotes rows that were sprayed with bordeaux, 8-6-40, in June and August (two sprayings during dormant period); "B" denotes rows that were sprayed with bordeaux, 8-6-40, in August (one spraying during dormant period); "C" denotes rows that were sprayed with bluestone solution, 1–15, in June and August; "D" denotes rows that were sprayed with bluestone solution, 1–15, in August; "E" denotes rows that were sprayed with Cooper's bordeaux, 10–40, in June and August; "F" denotes rows that were sprayed with Cooper's bordeaux, 10–40, in August; "G" denotes rows that were sprayed with Lawes Anti-Blight, 10–40, in June and August; "H" denotes rows that were sprayed with Lawes Anti-Blight, 10–40, in August.

No. of Row.	Specific used during Growing-period.	When applied.
		Peach Section.
A 1 B 2	Bordeaux, 2-3-50 ..	First, when early fruits began to ripen. Second, about three weeks later.
A 3 B 4	Bordeaux, 2-3-50 ..	First, when the fruit had set. Second, when early fruits began to ripen. Third, about three weeks later.
A 5 B 6	Bordeaux, 2-3-50 ..	First, when the fruit had set. Second, one month later (stoning-period). Third, when early fruits began to ripen. Fourth, about three weeks later.
A 7	Check row	No spraying during growing-period.
B 8 A 9	Lime-sulphur, 1–130 ..	First, when early fruits began to ripen. Second, about three weeks later.
B 10 A 11	Lime-sulphur, 1–130 ..	First, when the fruit had set. Second, when early fruits began to ripen. Third, about three weeks later.
B 12 A 13	Lime-sulphur, 1–130 ..	First, when the fruit had set. Second, one month later. Third, when early fruits began to ripen. Fourth, about three weeks later.
B 14	Check row	No spraying during growing-period.
A 15 B 16	Atomic sulphur, 4 lb. to 50 gal.	First, when early fruits began to ripen. Second, about three weeks later.
A 17 B 18	Atomic sulphur, 4 lb. to 50 gal.	First, when the fruit had set. Second, when early fruits began to ripen. Third, about three weeks later.
A 19 B 20	Atomic sulphur, 4 lb. to 50 gal.	First, when the fruit had set. Second, about one month later. Third, when early fruits began to ripen. Fourth, about three weeks later.
A 21 B 22	Check rows	No spraying during growing-period.
C 23 B 24	Bordeaux, 2-3-50 ..	First, when the fruit had set. Second, when early fruits began to ripen. Third, three weeks later.
C 25 D 26	Lime-sulphur, 1–130 ..	First, when the fruit had set. Second, when early fruits began to ripen. Third, three weeks later.

No. of Row.	Specific used during Growing-period.	When applied.
	Peach Section—continued.	
C 27 D 28	Atomic sulphur, 4 lb. to 50 gal.	First, when the fruit had set. Second, when early fruits began to ripen. Third, three weeks later.
C 29	Check row	No spraying during growing-period.
F 30 E 31	Cooper's bordeaux, 1–10	First, when the early fruits began to ripen. Second, three weeks later.
F 32 E 33	Cooper's bordeaux, 1–10	First, when the fruit had set. Second, when the early fruits began to ripen. Third, three weeks later.
F 34 E 35	Cooper's bordeaux, 1–10	First, when the fruit had set. Second, one month later. Third, when early fruits began to ripen. Fourth, three weeks later.
F 36	Check row	No spraying during growing-period.
	Nectarine Section.	
G 37 H 38	Lawes Anti-Blight, 1–10	First, when early fruits began to ripen. Second, three weeks later.
G 39 H 40	Lawes Anti-Blight, 1–10	First, when the fruit had set. Second, when early fruits began to ripen. Third, three weeks later.
G 41 H 42	Lawes Anti-Blight, 1–10	First, when the fruit had set. Second, one month later. Third, when the early fruits began to ripen. Fourth, three weeks later.
G 43	Check row	No spraying during growing-period.

Immediately after the August spraying the land was ploughed so as to bury all dead leaves, twigs, rubbish, &c. The soil was kept well cultivated and free from weeds right throughout the season. The weather during the period was very wet, with exceedingly unstationary temperatures. Such weather considerably hampered spraying operations, but the specifics were applied as near as possible to the times stated in the foregoing plan. The fruit was well thinned, and all fruits showing rot were gathered and destroyed once a week after the stoning-period was passed. By a system of card indexes a record of the number of fruits produced on each tree and the percentage of diseased fruits was kept. The percentage of rot found in each row will, however, be sufficient for the purposes of this report. The percentage for each row in rotation is as follows:—

No. of Row.	Percentage of Rot.	No. of Row.	Percentage of Rot.	No. of Row.	Percentage of Rot.
1	9·383	16	14·440	30	35·600
2	44·985	17	15·562	31	14 754
3	21·712	18	3·826	32	10·982
4	Nil	19	4·904	33	19·439
5	Nil	20	21·214	34	53·703
6	1·574	21	33·104	35	4·580
7	24·460	22	5·586	36	2·777
8	27·969	23	0·849	37	1·004
9	42·563	24	9·972	38	1·806
10	28·897	25	6·797	39	42·857
11	15·202	26	7·055	40	52·941
12	53·602	27	8·972	41	44·696
13	10·673	28	9·941	42	24·800
14	29·859	29	9·223	43	34·500
15	10·598				

These figures show very conflicting results. In some of the tests it is apparent that spraying has diminished the disease somewhat. On the other hand, we find a lesser percentage of rot on trees that were not sprayed during the growing-period than on those trees that were sprayed three and even four times. Owing to the numerous varieties under treatment it required a good deal of time and work to spray each variety at its proper season. It would be a decided advantage if a block of trees of a few varieties only could be obtained for further spraying-tests.

THE SPRAYING-SPECIFICS AND THEIR EFFECTS.

Some of the specifics used were very severe on the developing fruit and foliage. In some instances the remedies were as bad if not worse than the disease. I will deal with each one separately, as follows :—

Bordeaux Mixture.—This was applied at the strength of 3-5-50, and each mixing tested for neutrality before using. In every case it caused the foliage to fall. This usually occurred about ten or fourteen days after the application, and was more pronounced after heavy rain. Wherever the bordeaux was applied to trees that had just set their fruit it diminished the crop to a serious extent, and scorched the skin of the half-developed fruits on some varieties of trees. This scorching was so severe in some instances that the fruit cracked before reaching maturity, and was absolutely unfit for sale. During the period from the middle of December to the middle of January the bordeaux-sprayed portion of the block gave the impression that the season of the year was autumn. Dead and withered leaves were scattered by every breeze. The fruit on all defoliated trees, as might be expected, never attained its normal size or flavour.

Lime-sulphur was used during the growing-period at a strength of 1–130. This strength scorched the very tender tips of the young leaves in the early part of the season, but there was no damage later on in the season. The foliage developed normally and compared very favourably with the unsprayed rows in the block. Sherwin-Williams was the brand of lime-sulphur used. I am of opinion that this specific can be used at a stronger strength with safety—say, 1–110 or 1–120.

Atomic sulphur was applied at a strength of 4 lb. to 50 gallons of water. The foliage assumed a very healthy appearance, apparently equal to if not better than unsprayed trees. There were no signs of scorching or dropping of fruit.

Cooper's bordeaux was used during the growing-period at a strength of 1 lb. to 10 gallons of water. It was very nearly as severe on the foliage as the bordeaux mixture, but did not affect the fruit to the same extent.

Lawes Anti-Blight was used during the growing-period at a strength of 1 lb. to 10 gallons of water. The effect on the foliage of the nectarines was simply disastrous. All trees treated were practically defoliated by the middle of December, and the fruit hanging on nude arms. Needless to say, it never developed to normal size or usual flavour, and cracked badly on some varieties. The trees have now grown a new crop of foliage, but the fruit-buds are very deficient, and it is apparent that next season's crop will be very light.

From the results of these experiments it is evident that all the copper compounds at the strengths applied are injurious to both fruit

and foliage, and their effectiveness as controllers of brown-rot doubtful. The weight of evidence is in favour of the sulphur compounds, and further tests with these two specifics at increased strengths would appear to be advisable.

II. SPRAYING-TEST ON APRICOTS FOR BROWN-ROT AND RUST.

A spraying experiment was also carried out at Arataki during the past season to ascertain whether brown-rot on apricots can be controlled by this means. An extra spraying was also given immediately the fruit was picked to determine if one specific is more effective than another in combating the rust that usually defoliates the trees early in the autumn.

A block of twenty-nine rows with an average of three trees per row was selected for treatment. Every alternate row, starting with number 1, was sprayed with bordeaux, 8-6-40, twice during the dormant period—*i.e.*, June and August. The balance of the rows received one application of 8-6-40 bordeaux during August. The following plan will illustrate how the trees were treated during the dormant and growing periods. A careful record was kept of the fruit produced by each tree, and the percentage of brown-rot-infected fruit found in each row, which is given in the last column of the chart.

NOTE.—The letter "A" before the numbers of the rows denotes rows that were sprayed twice during the dormant period (once in June and once in August) with 8-6-40 bordeaux; "B" denotes rows that were sprayed once with 8-6-40 bordeaux in August; "C" denotes rows that were sprayed with Lawes Anti-Blight, 10–40, in June and again in August; "D" denotes rows that were sprayed in August only with Lawes Anti-Blight, 10–40.

No. of Row.	Spray and Strength.	When applied.	Percentage of Rot.
A 1 B 2	Bordeaux, 3-4-40	First, when early fruits began to ripen Second, about three weeks later .. Third, as soon as the fruit was picked	0·367 0·162
A 3 B 4	Bordeaux, 3-4-40	First, when the fruit had set .. Second, when early fruits began to ripen Third, about three weeks later .. Fourth, as soon as fruit was picked ..	Nil. 0·1307
A 5 B 6	Bordeaux, 3-4-40	First, when the fruit had set .. Second, one month later .. .. Third, when early fruits began to ripen Fourth, about three weeks later .. Fifth, as soon as the fruit was picked	1·015 Nil.
A 7	Check row	No spraying during growing-period ..	4·175
B 8 A 9	Lime-sulphur, 1–130	First, when early fruits began to ripen Second, about three weeks later .. Third, as soon as the fruit was picked	1·785 1·515
B 10 A 11	Lime-sulphur, 1–130	First, when the fruit had set .. Second, when early fruits began to ripen Third, about three weeks later .. Fourth as soon as the fruit was picked	Nil. 0·3831
B 12 A 13	Lime-sulphur, 1 130	First, when the fruit had set .. Second, one month later .. .. Third, when early fruits began to ripen Fourth, about three weeks later .. Fifth, as soon as the fruit was picked	0·1536 Nil.

No. of Row.	Spray and Strength.	When applied.	Percentage of Rot.
B 14	Check row	No spraying during growing-period ..	No crop.
A 15	Atomic sulphur, 4 lb. to 50 gal.	First, when early fruits begin to ripen	6·069
B 16		Second, about three weeks later ..	Nil.
		Third, as soon as the fruit was picked	
A 17	Atomic sulphur, 4 lb. to 50 gal.	First, when the fruit had set ..	Nil.
B 18		Second, when early fruits began to ripen	No crop.
		Third, about three weeks later ..	
		Fourth, as soon as fruit was picked ..	
A 19	Atomic sulphur, 4 lb. to 50 gal.	First, when the fruit had set ..	Nil.
B 20		Second, one month later	No crop.
		Third, when early fruits began to ripen	
		Fourth, about three weeks later ..	
		Fifth, as soon as the fruit was picked	
A 21	Check rows	No spraying during growing-period ..	0·1098
B 22			Nil.
C 23	Lawes Anti-Blight, 1 lb. to 10 gal.	First, when early fruits began to ripen	Nil.
D 24		Second, about three weeks later ..	No crop.
		Third, as soon as fruit was picked ..	
C 25	Lawes Anti-Blight, 1 lb. to 10 gal.	First, when the fruit had set, ..	0·5102
D 26		Second, when early fruits began to ripen	Nil.
		Third, about three weeks later ..	
		Fourth, as soon as fruit was picked ..	
C 27	Lawes Anti-Blight, 1 lb. to 10 gal.	First, when the fruit had set ..	No crop.
D 28		Second, one month later	
		Third, when early fruits began to ripen	
		Fourth, about three weeks later ..	
		Fifth, as soon as fruit was picked ..	
C 29	Check row	No spraying during growing-period ..	No crop.

EFFECT OF SPECIFICS ON FRUIT AND FOLIAGE.

None of the specifics used injured the foliage in the least. Bordeaux and Lawes Anti-Blight made some of the fruit very unsightly, especially when sprayed a week or ten days before picking. Such fruit had to be thoroughly washed before packing. The fruit on some varieties treated with bordeaux and Lawes specific cracked very considerably. This did not occur on fruits treated with lime-sulphur and atomic sulphur.

In this test bordeaux gave the best results, but I am of the opinion that it will have to be discarded owing to the fact that it disfigures the fruit to such an extent. Lime-sulphur gave very good results. I think the strength could be increased with advantage for apricots in any further tests that may be made. The crop was very light on all trees treated with atomic sulphur, so I do not consider it to be a fair test for this compound. The same applies to Lawes Anti-Blight and the trees in that portion of the experiment.

RUST-CONTROL.

The spraying has made a vast difference to the foliage of all trees treated. The untreated rows commenced to show signs of rust early in March, but not in a serious form. The following was the condition of the trees when examined for report on 1st April :—

Bordeaux mixture (rows 1 to 6) : All trees holding the leaves well ; no rust showing ; foliage somewhat yellow in colour ; no apparent

difference in rows. Check row (row 7)—A good deal of rust; a fair percentage of the foliage already fallen.

Lime-sulphur (rows 8 to 13): Hardly equal to rows sprayed with bordeaux; foliage slightly affected with rust; no apparent difference in rows. Check row (row 14)—Greater part of foliage fallen.

Atomic sulphur (rows 15 to 20): A slight amount of rust; foliage about equal to trees treated with lime-sulphur; no apparent difference between rows. Check rows (rows 21 and 22)—Affected with rust; greater part of foliage fallen; no apparent difference between rows.

Lawes Anti-Blight (rows 23 to 28): Free from rust; foliage still abundant; no apparent difference between rows. Check row (row 29)—Practically defoliated; rust bad.

SPRAYING-TESTS AT TE KAUWHATA.

In connection with a series of spraying-tests at the Department's horticultural stations, arranged by the Horticulture Division, the following reports on experiments carried out at Te Kauwhata Horticultural Station during the past season have been supplied by the Manager, Mr. J. F. Shepherd. Further reports will be published in due course.

I. BLACK-SPOT OF PEARS (*VENTURIA PIRINA*).

These experiments were conducted with a view to finding the best sprays with which to combat black-spot under the most difficult conditions of this district. Eight tests had as an object the ascertaining of the better spray to apply just before the buds burst, or what is commonly known as the dormant spray. They were as follows:—

Twelve trees sprayed with bordeaux mixture, 8-6-40; twelve trees sprayed with bordeaux mixture, 8-5-53; twelve trees sprayed with bordeaux mixture, 8-4-66; twelve trees sprayed with bordeaux mixture, 8-3-80; twelve trees sprayed with bordeaux mixture, 8-2-93; twelve trees sprayed with bordeaux mixture, 8-1-106; twelve trees sprayed with bordeaux mixture, 8-0-120 (or bluestone solution, 1–15).

These sprays were applied as the varieties reached the right stage of development—*i.e.*, 10th to 21st September, 1917.

Twelve trees were sprayed with Professor Pickering's bordeaux, winter strength. Twenty-one trees were left unsprayed, as a check plot.

The colour-bud (or pink) spray and subsequent sprayings were done as the various varieties reached the right stage of development, and three spraying-compounds—viz., lime-sulphur, Professor Pickering's bordeaux, and bordeaux mixture—were in each case applied to the trees receiving the foregoing series of sprays, as follows:—

(1.) Pink spray: Lime-sulphur, 1–20. Later application — lime-sulphur, 1–80, plus arsenate of lead.

(2.) Professor Pickering's bordeaux, spring strength: One application, summer strength; later sprays, spring strength, plus arsenate of lead.

(3.) Bordeaux mixture, 6-5-50. Later application — 3-4-40, plus arsenate of lead.

(1.) It was very noticeable in experiment No. 1 that lime-sulphur 1–80 totally failed to kill the spot. On varieties specially liable to infection, notably Williams Bon Chretien and Fertility, subsidiary tests were carried out in strengths 1–60 and 1–70. In each case the foliage was badly burnt, more especially on the Williams, and in each case the spot was showing badly.

(2.) Professor Pickering's summer-strength bordeaux also failed to kill the spot, and as a subsidiary test a few trees were sprayed with spring strengths, also a few with winter strength, plus arsenate of lead in each case. The winter strength burnt the foliage badly, but with the spring strength there was practically no scorching of the foliage, and as it checked the spot much better than the summer formula it was adopted throughout the season.

Professor Pickering's bordeaux-mixture formulæ are as follows: Winter strength, 6 lb. 6½ oz. of copper sulphate to 100 gallons of water (lime-water included); spring strength, 4 lb. copper sulphate to 100 gallons of water (lime-water included); summer strength, 2 lb. 2 oz. copper sulphate to 100 gallons of water (lime-water included).

(3.) Bordeaux mixture (plus arsenate of lead): This spray stood out easily as being the best and most effective spray, securing an 85-per-cent. clean crop. In addition, the growth of the trees was stronger, with larger, brighter foliage, and no noticeable scorching. This was most apparent on varieties which are very subject to spot, such as Williams Bon Chrétien, Fertility, Clapp's Favourite, and Dr. Jules Guyot.

Summary: In the series of dormant sprays, no marked difference in the results could be observed as against the trees left unsprayed.

II. RED-OIL SPRAYS FOR SCALE ON APPLES.

These experiments were carried out to find the relative values of various strengths of the red-oil sprays "Harbas" and "Gargoyle," in the control of scale. The applications were as follows:—

(1.) Harbas red oil, 1 in 12—one application only.
(2.) Harbas red oil, 1 in 14—one application only.
(3.) Harbas red oil, 1 in 16—one application only.
(4.) Gargoyle red oil, 1 in 12—one application only.
(5.) Gargoyle red oil, 1 in 14—one application only.
(6.) Gargoyle red oil, 1 in 16—one application only.

The trees were sprayed on 6th and 7th September, 1917. Some of the trees in each experiment were badly infested with mussel scale, and as the winter was an exceptionally wet one the sprays were not applied until the dates mentioned, hence the buds were well advanced.

The trees in No. 1 and No. 4 had a few limbs killed with the spray, but the damage was immaterial. The sprays were effectual in destroying the scale.

In No. 2 and No. 5 the scale was destroyed. No branches were killed, and, as far as could be seen, very few buds were destroyed. A little live scale has been noticed in No. 3 and No. 6. The sprays have had no detrimental effect on the trees whatever.

III. MILDEW-SPRAYS FOR APPLES.

Experiments were also carried out to determine the best mildew-spray for apples, the test being one of lime-sulphur *versus* atomic sulphur. The scheme was as follows:—

(1.) Pink spray: Lime-sulphur, 1–30, 21st September. Later application, lime-sulphur, 1–100, plus arsenate of lead, 2nd–6th October.

(2.) Lime-sulphur, 1–80, 5th and 6th November. Lime-sulphur, 1–120, plus arsenate of lead, 27th and 28th November, 4th and 5th January.

(3.) Atomic sulphur, 8 lb. to 100 gallons water, 5th and 6th November. Atomic sulphur, 1–10, plus arsenate of lead, 27th and 28th November, 4th and 5th January.

(4.) Atomic sulphur, 1–12, 5th and 6th November. Atomic sulphur, 1–12, plus arsenate of lead, 27th and 28th November, 4th and 5th January.

Both these sprays controlled the disease well, and without detriment to the foliage. If anything, the trees sprayed with lime-sulphur carried the brighter foliage, though the difference was not marked. The trees carried good crops of fruit.

At the last Franklin show, in good classes for pedigree Berkshires, the Ruakura pigs scored two championships and all first prizes but one. Pigs from the Ruakura herd are in good demand, the difficulty being to keep up the supply, especially for boars fit for service and sows in pig.

In the article on "Strawberry-culture" in last month's *Journal* it was printed, under the heading of "Cultivation," that "the soil may be kept stirred to a maximum depth of 6 in. between the rows, but never nearer than 2 in. to the plants." The latter part of the sentence should have read, "but never more than 2 in. deep close to the plants."

A King-country correspondent writes recommending ready methods of establishing paspalum in steep country which is going back—better grasses dying out and noxious growths spreading. A good plan when laying rabbit-poison is to put a pinch of seed into the spade-cut; this may also be done when pulling ragwort or grubbing other weeds. Again, when going around the stock, hand-stripped seed can be carried in a pocket and dropped in rabbit-scratches and on ground torn by cattle.

WORK FOR THE COMING MONTH.

THE ORCHARD.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

ALTHOUGH the orchard is not as exacting in the way of daily attention as the dairy farm or many other branches of work on the land in which the care of live-stock is in question, there is no period during the whole year when an orchardist can afford to take anything like a prolonged holiday without making adequate provision for the necessary work to be attended to during his absence.

The slackest period of the year is toward the end of the autumn season. The duration of this period, however, is considerably affected by the nature of the respective orchards. The month of March sees the end of the stone-fruit season, and it is not imperative to commence the new season's operations till early in May. On the other hand, the pip-fruit grower usually finds himself occupied in harvesting his crop well on to the end of April, and as the average New Zealand orchard includes both stone and pip fruits the holiday season of the grower is necessarily confined to the latter part of April and the beginning of May. In taking a holiday even at this time the orchardist should not lose sight of the fact that an early commencement of the new season's work is of the utmost importance. He should do all that he can in this direction before leaving, or have all arrangements made for an immediate commencement on his return.

WORK OF THE DORMANT SEASON.

Too much importance cannot be placed upon the thoroughness with which the dormant season's work should be carried out. In view of the spread of brown-rot and the heavy damage done by that disease, much of this work is even of greater importance now than formerly.

The following items cover the principal work of the season in question: Pruning the various classes of trees; cutting and trimming hedges; attention to drainage; destruction of prunings, &c., and a thorough cleaning-up of the orchard; spraying for the control of insect pests and fungus diseases; cultivation, &c. This work should be planned and carried out in consecutive order. In common practice, varied to suit special circumstances, this should be somewhat on the following lines: Attend to all questions of drainage, hedge-cutting, &c., and have the work completed in time to commence the pruning of stone-fruits immediately the trees are ready; prune stone-fruits and gather and destroy all pruning and other rubbish in the stone-fruit section; spray the trees—particularly peaches and nectarines—with 8-6-40 bordeaux, or lime-sulphur, 1–15. Cultivate the land with a view to thoroughly covering all dead foliage, &c. Prune pip-fruits and spray the trees with an oil spray, 1–12, or, if a change from the oil is considered desirable, use lime-sulphur, 1–10; in either case the spraying may be

deferred till August. After pruning gather and destroy all pruning and other rubbish in the pip-fruit area; plough the land with a view to thoroughly covering all fallen foliage, &c.

The remaining work, which will be done in the late winter or early spring, including cultivation, spraying for the control of fungus diseases, &c., will be dealt with later.

SAN JOSE SCALE.

One of the special circumstances referred to as likely to vary the scheme of operations set out has to do with San Jose scale. This scale, although not one of the most difficult to destroy, is one of the most difficult of all scales to thoroughly eradicate from the orchard. The difficulty is due to the great rapidity in which the insects increase. Eradication necessitates complete destruction practically in one season, for if any small number of insects escape the spraying the infestation is likely to be almost as bad as ever by the end of the season.

The damage that a bad attack of San Jose scale is capable of doing in a short time to an otherwise healthy tree is altogether surprising. In the case of stone-fruits anything like a bad attack is liable to kill out portions of the tree in one season, and the whole tree in two seasons. The most pronounced damage is done during the autumn, after the sap has ceased to flow and prior to the scales becoming dormant for the winter. During the growing season the sap removed from the tree is more or less replaced, and the life of the tree maintained. It is quite a common thing in the spring to note more or less dead branches in the trees that at the end of the previous growing season were clothed in comparatively healthy foliage, this damage being mainly due to the inability of the tree to replace sap lost to the insects in the late autumn.

This clearly suggests the importance of checking the ravages of the scale as early as possible in the season. To do so it is advisable to run through the tree, removing all dead twigs, &c., which are less readily distinguished after being coated with spray, and then spray the trees with 1–15 lime-sulphur, rather than defer the spraying until all the pruning has been completed. Lime-sulphur is recommended for two reasons. In the first place it is a fungicide, and in the second it is less dangerous to the tree than oil applied at this stage. Oil may be used later to make doubly sure of the job.

BROWN-ROT.

Orchardists are urged to take strong measures for controlling brown-rot during the dormant season, and to follow up the treatment as the season advances. For this purpose clean up the orchard as thoroughly as possible, and, above everything, gather and destroy all mummified fruit. Plough the orchard after the foliage has fallen, thoroughly covering all leaves, &c., and dig over those parts missed by the plough. Spray with a winter fungicide, preferably 8-6-40 bordeaux, when the buds show pink—not earlier. Apply thoroughly at a pressure of 200 lb. to 250 lb. to the square inch. Spray again when two-thirds or most of the blossoms have fallen with 1–120 lime-sulphur, or 8 lb. to 10 lb. of atomic sulphur to 100 gallons of water. The fruit should be well thinned, and all diseased fruit removed and destroyed. It is also advisable to keep the fruit well covered with spray as it approaches the ripening-stage. Attention is drawn to the special notes and reports on brown-rot control appearing elsewhere in this issue.

RUST OF STONE-FRUITS.

Practically all stone-fruits are liable to be attacked by the fungus disease commonly known as rust. English plums and some varieties of peaches and nectarines are very subject to infection. The disease is particularly destructive to the foliage of the trees, but it also disfigures the fruit, and in bad cases a considerable percentage of the crop is for all practical purposes entirely destroyed.

In common with many other fungus diseases of stone-fruits winter treatment has to be mainly relied upon. This is practically the same as that recommended for brown-rot. In the case of the plum and apricot summer spraying can be carried out with advantage. The only drawback to summer spraying in this case is the objection to marring the appearance of a fruit, which is eaten unpeeled, with the dregs of a spraying-compound. With the peach and nectarine the objection to summer spraying is twofold. In addition to disfiguring the fruit with the spray, there is the danger of scorching the foliage. In either case, however, if the attack is sufficiently bad to blemish the fruit summer spraying should be resorted to, as with brown-rot.

Lime-sulphur, 1–120, should be used until after the fruit is picked, and then 3-4-40 bordeaux may be used on apricot and plum trees. However, if the winter treatment is properly attended to, and the soil kept well cultivated during the summer with a view to keeping the tree well supplied with moisture, there should be little need for summer spraying.

WOOLLY APHIS.

There are two spraying methods employed in the dormant season for the control of woolly aphis. One is to depend on the strong oil-spray that is used for general purposes, applied at a high pressure, and the other is to spray twice with oil. In the latter case a comparatively weak mixture, 1–25 to 1–30, is first used. This application is made as soon as the foliage has fallen sufficiently to allow the work to be done satisfactorily. This is followed with another oil-spraying, usually about 1–15, as late in the season as the development of the tree will permit. The first application destroys all the outside woolly matter that acts as a protection to the colony. This, through the action of the weather, entirely disappears before the second application is made, leaving the colony unprotected and consequently liable to be more readily and thoroughly destroyed. The double spray, although it requires more material and labour, makes a very much better job than the single application.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

THE month of May is a comparatively slack time in the poultry-keeping year, and therefore affords a good opportunity for overhauling the plant and making various preparations for the busier period ahead. The stock now being at its minimum in numbers, this is the best time for treating the runs, and a sufficient area should be turned over, limed, and sown down to accommodate next season's young birds

right through their growing stage. Wet runs should also be drained. The breeding quarters and the hatching and brooding plant should receive careful attention, and provision made for any extended operations. All gates and fences, &c., should also be put in thorough order. The poultryman who is free of the worry of these things when the busy season arrives is in a far better position to make a success of what is in reality a very exacting business.

GRIT, SHELL, AND CHARCOAL.

The value of grit for the maintenance of fowls in a healthy, thriving state can hardly be exaggerated—it is indeed a paramount necessity. It is not generally realized that the lack of grit means not only a reduced egg-yield, but is a frequent cause of liver troubles, crop troubles, indigestion, and consequent disorganization of the system. The different uses to which fowls put grit are probably not all known. It is said that one of its uses is to supply mineral to the body. The mere fact, however, that fowls eat grit by instinct, knowing they maintain better health with it than without it, is for us sufficient proof of its value, and it should be supplied with an unsparing hand. Grit is undoubtedly as essential to the well-being of fowls as good feeding and housing.

The best form of grit is small pieces of sharp gravel or similar material. These collect in the gizzard and are there used for grinding the food, which assists the bird's digestion. In other words, grit acts as teeth for the fowl. Where poultry have free range and the ground is of a gravelly nature the birds are afforded an opportunity of picking up all the grit they require, but on a heavy clayey soil, even although they have their liberty, grit should be provided. On the farm where, say, a hundred fowls are kept it is surprising how soon they will consume a dray-load of gravel, providing, of course, it is sufficiently small for the birds to swallow. In the case of fowls kept in a confined area, any neglect to give a regular supply of grit is not only cruel but decidedly unprofitable.

Not only should fowls be supplied with a liberal quantity of sharp stone grit, but, in addition, they should have free access to crushed oyster or other sea shell, as an egg-shell-forming material. It is not too much to say that many thousands of shell-less eggs are produced in the Dominion annually, simply because sufficient lime is not provided for the shell of the eggs. It only stands to reason that for the high-type layer to produce her maximum number of shelled eggs she must have the necessary material to do it with. This is not to say that want of lime is responsible for all the soft eggs produced. The trouble may be due to a bird being too fat, or to an internal abnormal obstruction, while very often an oversupply of meat, meat-meal, or the use of condiments, is the cause of the trouble.

The best method of feeding grit and crushed shell is to place each in a separate receptacle. Sometimes they are mixed and fed in the one self-feeding hopper. This is a mistake, because the laying birds are often unable to obtain the necessary shell substance owing to the stone material, which is usually eaten in less quantities, being in the way.

Charcoal, such as willow-wood charcoal, is another thing that should be kept in reach of birds of all ages. There is nothing better for aiding digestion, while it is also a good preventive of disease. Before feeding charcoal it should be broken into small pieces, sieved,

and placed in a self-feeding hopper or similar receptacle for the birds to pick at.

EGG-LAYING COMPETITIONS AND PUREBRED STOCK.

No one can deny the great good done by egg-laying competitions since their initiation in the Dominion in proving the superior value of purebred types over both the mongrel fowl and the show-pen monstrosity. Some of the competing birds in the various tests conducted have not only produced sensational records in egg-yield, but were also good specimens of the breed they represented. In other words, beauty and usefulness were happily combined. This is how it should be. Only birds possessing breed-type and general characteristics should be allowed to compete.

The Christchurch Utility Poultry Club is to be congratulated on the manner in which, with a view to correcting existing weaknesses in this respect, it has made the conditions under which valuable special prizes may be competed for in this year's test. A glance at the schedule shows that no team will be allowed to compete which contains one or more birds that are not fair specimens of their breed. It is to be hoped that those who control the Papanui test will adhere strictly to the conditions set out, and not allow any of these prizes to be won by other than purebred stock. Of course, in all schedules connected with egg-laying tests, whether it be for one or six birds, the rule is clearly laid down that the birds must be purebred. This is a golden rule, but, judging by some of the specimens seen in tests recently carried out, it seems clear that the rule is by no means enforced. Not only were birds to be seen taking part which were inferior specimens of the breed they were entered under, but in some cases it would appear that foreign blood had recently been introduced. In other words, they were merely black or white birds, as the case might be, and in no way conformed to standard requirements.

It may be argued that egg-laying power must be the first consideration, and that breed type has nothing to do with profitable poultry-breeding. Of course, this is a mistake, as it is well known that in any class of live-stock desirable characters can only be maintained, and the undesirables eliminated, by careful selection and breeding from purebred animals. What applies to other branches of live-stock applies equally in the case of poultry.

It must be admitted that a first cross may prove a phenomenal egg-producer, but it does not follow that like will produce like in the offspring. The rule that like produces like only applies where the parents are absolutely purebred on both sides. The wise poultryman will never dream of introducing a cross-bred bird, or one weak in breed-points, to a flock of purebred layers. He realizes the risk he would be taking not only in regard to robbing his strain of the beauty they possess (for any purebred bird is beautiful), but he also knows the great danger of having a reversion and the ruination of his strain for ever. This is where the great weakness lies in allowing a breeder to compete with a crossbred pen, and to distribute his strain—represented as purebred—through the country. Many cases have come under my notice where good flocks of purebred poultry have been practically ruined simply by the introduction of a crossbred male alleged to be pure. Even allowing that for certain purposes a first-cross may be preferable to a purebred, the fact remains that it takes

two purebreds to make a first-cross. It will, therefore, be seen that if our useful breeds of poultry are not kept in a state of purity it will be impossible to produce even a true first-cross. The great weakness in breeding from other than purebred stock is the inability to transmit desirable characters through subsequent generations. The same applies, to a lesser degree, in the case of birds of divergent types.

Much has been and is still being done to have our utility classes in the show-pen judged on a sane standard, whereby points indicative of breed-character, constitution, and laying-power are reckoned of prime importance. This principle has much to commend it, but of what avail is it to be working with this end in view in poultry shows, if it is being ignored in the egg-laying competitions? The fanciers of old performed a great task in bringing to their high state of purity the various useful breeds of poultry we have at our command to-day, and it should be our aim that while improving them from a useful point of view we do not go to the other extreme. It will be a step in the right direction when those in charge of egg-laying tests will see to it that all birds, before being allowed to compete, shall pass a committee of competent judges as to their purity, whereby any bird not conforming to breed-standard—at any rate to a fair degree—will be rejected. The sooner this is strictly enforced the sooner will the competitions be adding to the good work they have already done. In the show-pen only purebred birds are of any consideration whatever, and this should apply with equal force to the egg-laying competition pen.

It has often struck me as a remarkable contradiction that keen utility-poultrymen will theorize by the hour at a poultry show on the necessity of judging birds strictly in accordance with the standard laid down, and yet they will send to an egg-laying test a team which in no way conforms to the standard which they themselves advocate. However, while some of the strains of the useful breeds of poultry are showing strong signs of deterioration, both in size and breed-quality, it is gratifying to know that we have breeders in the country who possess stock of undoubted laying-capacity, combined with the desired size and breed type.

THE APIARY.

E. A. EARP, Apiary Instructor.

MANAGEMENT OF SUPERS.

As recommended last month, the removal of the supers should go on steadily as the bees form their winter clusters. In the case of very strong colonies it will often be found difficult, if not impossible, to confine the bees to one story without seriously diminishing winter stores and unduly crowding the bees. In these cases it is best to leave the supers on till the spring.

The best place for winter stores is in the hive, and, however careful the beekeeper may be in replenishing these, if the honey is removed from the hives he still runs the risk of allowing the bees to starve out if the honey is not within their reach at all times during the cold weather. There are very few districts in New Zealand where brood-rearing absolutely ceases during the winter, especially when the hives are well sheltered, and the bees require food at all times and seasons.

On no account should they be allowed to winter in more than two stories. In many cases they will be showing a tendency just now to go as high as they can get in the hives, and where this happens it will usually be found that the combs in the bottom story are deserted and dry. A rapid examination will soon show the beekeeper whether this state of affairs obtains, and, if so, he should remove the bottom story, leaving the cluster undisturbed.

Where queen-excluders have been left on the hives they should be removed, because it sometimes happens that the bees will go through the excluders to the stores above, leaving the queen to perish below. There is always a tendency for the cluster to move to the warmer part of the hive, and an excluder will not act as a bar if the bees are dissatisfied with the lower story.

MATS FOR WINTERING.

To ensure that the bees are kept warm through the cold weather it is absolutely necessary that the frames should be well covered with good mats. Three or four are by no means too many to provide for each hive. Ordinary corn-sacks cut into pieces the size of a zinc queen-excluder answer the purpose admirably, and are very durable. Avoid using calico mats, as these are next to useless for wintering purposes. It is essential that the mats should fit exactly over the frames; if too small they admit draughts, and if too large the edges will protrude beyond the hive-covers, and in wet weather these will absorb sufficient water to cause the mats to become damp and unhealthy and the combs mouldy.

CLEARING WEEDS.

Keep the weeds down. A good clearing of the weeds round the hives in the autumn will suffice until the spring, and will add materially to the comfort of the bees and the well-being of the hives during the winter months. Not only should the entrances be cleared, but the ground all round the hives should be similarly treated, and the weeds raked up and destroyed.

CARE OF UTENSILS.

Utensils that have been in use during the extracting season should be thoroughly cleansed prior to storing away for winter. Remove all traces of honey from the extractor, tanks, uncapping knives, &c.; wash with boiling water, and dry thoroughly to prevent rusting. All metal parts liable to rust should receive a coating of oil. The cost of renewing working equipment is becoming a serious burden on the profits of the apiary. Prices are steadily increasing, and there is every probability in the near future of certain supplies being unobtainable. By a little judicious care and management the life of a beekeeper's working equipment can be prolonged, because much of the expense incurred in replacing damaged utensils is usually the result of sheer neglect. Loose washing covers should be made to cover the extractor and tanks in order to prevent these utensils getting coated with dust, which is likely to accumulate during the off season.

CARE OF HIVES.

At no other season is the welfare of the hives of such importance as during the next few months. Every hive should be raised from the ground the height of one brick, and if the situation is damp or low-lying

it is a good plan to raise the hives still more. This will tend to keep them free from slaters (wood-lice) and other insects, and will afford less harbour for mice, as well as ensuring that the hives have a free current of air beneath the bottom boards, and thus will be more likely to keep dry. Never rest the bottom-boards on the ground, or they will rot in a very short time, and become mouldy and evil-smelling.

Before bad weather sets in it is a good plan to give a coat of paint wherever it is needed, at the same time stopping up all cracks in the supers. Cracks afford ventilation during the summer months, but they are hardly to be advocated on that account, because the beekeeper will usually find that towards the end of the honey-flow the bees will use up much valuable time in gathering propolis to paste up the cracks in view of the approach of winter. The hives should be slightly canted forward, so that any rain which falls on them will drain off the alighting-board.

LEAKY HIVE-COVERS.

Apart from disease, there is no worse feature in an apairy than the presence of leaky roofs. A cover which allows moisture to trickle through is a constant menace to the colony it appears to shelter. Not only will the mats immediately beneath it become sodden and mouldy, but the cluster of bees in the hive stands in danger of extermination when frost sets in. There will then be pollution unspeakable on the bottom-board where the intruding moisture mixing with dead bees and waste pollen forms a rotten fermenting mass, with a stench which the order-loving bees must find even more obnoxious than does their owner.

There is no excuse for leaky covers. In the autumn the apiarist should examine them for any doubtful spots, and should either cover them with zinc, ruberoid, or some other waterproof material, or, if economy must be practised, he should cover with cheese-cloth, applying to the roof first a coat of paint, then the cheese-cloth, and then another coat of paint. This makes an effective waterproofing, and one which anybody can apply.

INFECTED MATERIAL.

Considering that the price of wax is steadily advancing, it behoves the beekeeper who has infected combs on hand to treat rather than destroy them. No good purpose is served by destroying combs from infected hives when by proper treatment the wax can be separated, to be afterwards worked up into comb foundation.

A capital steam appliance for dealing effectively with foul-brood combs was working at the last field-day at the Ruakura Apiary. It is the invention of Mr. C. S. Hutchinson, Waikato, and he fully demonstrated its effectiveness in melting old combs in a few moments, separating the slum-gum from the wax. The appliance is made in the form of a box and is lined with sheet iron. It is large enough to take a super of combs, and over all a steam-proof cover is fitted. The super is made to rest on four supports, and immediately below is fitted a tray or wire strainer to catch the slum-gum. This can be easily removed, so that it can be cleansed from time to time. The wax is finally caught on a tray, and is run off almost in a commercial form from the machine by means of a tube leading to the outside of the utensil. The method of generating the steam was by means of a 5-gallon drum, and the steam was conveyed by two tubes leading from the improvised boiler to the centre of the machine. A safety plug inserted in the drum prevents any possibility of an explosion in case

of the pipes conveying the steam becoming stopped up. It is certainly the most effective machine for dealing with old combs, and foul-brood-infected or pollen-clogged ones, yet brought before the beekeepers in the Dominion. It does away with the messy and tiresome work of cutting the wax from the frames and, in addition, does not interfere with the wires.

A point of importance raised at the demonstration of the machine, and one which must weigh with the beekeeper, is that of the destruction of the disease germs when dealing with infected combs. A test made showed that the thermometer registered 212° F., this being the highest temperature recorded during a trial run of the machine. In May, 1915, the United States Department of Agriculture published a bulletin dealing with the "Destruction of Germs of Infectious Bee Diseases by Heating," the author being G. F. White, M.D., Ph.D. The latter remarks: "The facts obtained to date are too meagre to justify anything more than a general statement regarding the minimum amount of heating that can be employed in rendering material containing the germs of American foul-brood non-infectious. Taking rather wide limits it may safely be said that the minimum temperature at which this can be done, if the temperature is applied for ten minutes, lies somewhere between 90° C. (194° F.) and 100° C. (212° F.). It seems quite probable, indeed, that a temperature less than 98° C. (208° F.) will suffice if applied for ten minutes. When 100° C. was used the spores of *Bacillus larvae* were killed in less than five minutes." These are the most reliable data existing dealing with the destruction of the spores of American foul-brood, and it should set at rest a doubt cast on the effectiveness of the heat generated in the machine described above.

A further point that should be generally noticed is that the beekeeper usually applies more heat in excess of the minimum amount required when destroying diseased material by heating. It may be said of Mr. Hutchinson's invention that it will be a boon to many beekeepers, as almost every one operating on a commercial scale is at times up against the problem of dealing quickly with large numbers of old combs. It is not the intention of the inventor to patent his idea, but rather to give beekeepers the benefit of his valuable experience, and thus help to solve the problem of dealing quickly with waste wax.

VITICULTURE.

S. F. ANDERSON, Vine and Wine Instructor.

THE month of May is often dry and affords an opportunity for general work such as underground draining, erection of espalier fences, &c. All vine-work is practically at a standstill, both under glass and outdoors. If the weather is warm houses infested with mealy bug may be fumigated with hydrocyanic gas. This should only be done with the house quite dry, and after sunset. The gas may now be left on all night. None but those with a knowledge of the dangerous qualities of this gas should attempt to use it. Full directions for its application are issued by this Department, and can be obtained on applying to the Horticulture Division.

CELLAR-WORK.

The vigneron will have much to do this month racking off the dry wines, which should be attended to as soon as the new wine has settled.

Choose cool, bright weather for the work. It is unwise to leave the wine on the lees any longer than to allow of it becoming moderately clear. Where sweet wines are being made fermentation takes much longer. If fermentation is being conducted in vats, as in the making of sweet red wine, keep them closely covered between times of attending to the pressing-down of cap and noting temperature. If the weather becomes close and muggy much watching is required to prevent the top becoming acetified. If this should occur—and it will instantl be noticed by the smell—at once skim off the top and take the skimmings right away clear of the fermenting-house: they are dangerous to the other wines. Then rack off the contents of the affected vat into clean casks to finish the fermentation.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.—CURRENT WORK.

In the warmer parts of the Dominion a small sowing of Snowball turnip may now be made. If sown at once and not too thickly the roots will develop. In the same districts cabbage, cauliflower, lettuce, and onion seeds may be put in. It has been found that cabbage-seed put in at the end of May produces heads for use by the end of October. In other localities the first week in April is as late as is safe.

Peas: In most districts it is customary to sow peas about the middle of May. In the warm parts of the North a fairly heavy sowing should be made. In those parts the early crops are the best, and it is impossible to get them long after the New Year, therefore every advantage should be taken of the season when they do succeed. In the coldest localities autumn sowing is not attended by much advantage. In places where the climate is between the two extremes autumn-sown crops do well enough to make their growing worth while.

Rhubarb: The winter variety should now be in use. The stools should not be pulled bare; always leave some young stalks growing. It is hardly worth while to plant the winter variety now, as it would not give any stalks during the coming winter, and it is better to wait till spring or early summer and then sow seeds.

Summer rhubarb: It is stated by some writers that rhubarb is practically evergreen in the Auckland District. I have no doubt that this is caused by the stalks being pulled too late in the season. The same persistency has been noticed in the warmer parts of Hawke's Bay, but it is rectified by reasonable treatment, and the tops die down in the proper manner. The proper time to use rhubarb is the early part of the season, before tree-fruits come in. When these are available the use of rhubarb should cease. This is the only way to get good stalks in spring. Growers for market were formerly accustomed to pull throughout January, but the best growers now cease pulling at the end of December. The growth made afterwards goes to develop crowns. Planting-time begins early in July, and continues till the middl of August, according to the district. Just as the crowns are beginning to move is the time to plant. Ground for new beds should be got ready as soon as possible. The deeper the soil is worked the better for the

crop. Rhubarb cannot be overmanured; it requires a liberal supply. It is useless to plant it in poor or very dry soil.

Asparagus: The tops are now dead; cut them down level with the soil. The tops should be burned. A liberal dressing of manure should be placed on the bed, leaving it exposed for the present. If the plants are in beds, rake soil off so as to expose the crowns before putting the manure on. The soil should not be returned until spring.

Seakale: Clear away the old leaves. Lightly fork the soil over, and give a good dusting of lime over soil and crowns.

Thin turnips that require it. Stir the soil between growing crops sufficiently often to keep the surface open and to prevent the growth of weeds.

PREPARATION OF THE SOIL.—FURTHER HINTS.

In last month's garden notes the effect of draining on soil-fertility was referred to. There are other matters that have vital effect on the successful use of soil in the cultivation of plants. The soil should be in a comparatively fine state of division—according to the form of the roots of different plants. Some plants have strong coarse roots, others exceedingly small and fine ones. The surface soil should be brought to a state of fineness suitable to the plant's habit. Thus, beans of any kind having a strong radicle and primary roots succeed in soil that might be too rough for carrots. Usually the size of the seed serves to indicate the degree of fineness of soil required.

When a seed is planted in soil in which there is a sufficient amount of moisture it shortly begins to swell. When germination takes place a shoot consisting of a short piece of stem—the epicotyl, on top of which is a bud—goes upward to the surface. This is to form the above-ground portion of the future plant. At the same time another part is going down into the soil. This consists of a piece of stem known as the radicle, from the end of which proceeds the primary root. The primary root goes vertically into the soil, and secondary roots branch out horizontally from it, these again branching, till, in the case of some plants, they form a network of roots. From the sides of these roots are projected numbers of very fine roots termed hair roots.

It is through these hair roots that plants take up most of the water and other matter on which their growth depends. These roots being exceedingly fine, it is necessary that the soil be in a fine state so that the roots may find ready contact with the soil-particles. Also, as these fine roots are easily killed either by drought or excessive wetness of soil, it is necessary that the surface soil be kept well tilled and free drainage provided to prevent waterlogging. In waterlogged soil very few hair roots are formed. A plant may have sufficient feeding-roots to sustain it while the weather is damp and comparatively cool, but they may be quite unable to sustain the plant when increased heat from the sun causes loss by evaporation from the leaves, especially as at that time there will be less moisture in the soil and the feeding-roots too few to draw enough water from the soil-particles, though there might be an ample supply if the plant were properly furnished with roots.

A seedling plant takes no nourishment from the soil until hair roots are formed and the first rough leaf is above the soil. In the meantime the embryo plant is sustained by plant food stored in the seed. This points to the necessity of planting seed at a depth in accordance with its size, so that its top may reach the air in due time, and the import-

ance—as in the case of small seeds—of a finely broken surface, so that the seedlings may easily break through.

Not only should the surface soil be finely divided, it should be also moderately firm. In loose soil the hair roots do not find ready contact with the soil-particles, consequently many of them may perish, and the plants make a feeble start. During the summer months, which, of course, is the time when most crops are grown, plants must necessarily draw most of their nourishment from the supply stored in the soil. Whatever amount of plant-food may be in the soil it will not be available unless there is a sufficiency of moisture.

If the soil is deep and in proper condition water stored in the soil is drawn to the surface by the phenomenon known as " capillarity " as the soil in that position becomes dry. While the surface soil is fully charged with water there is no capillary action ; but as the top layer of soil loses its moisture it draws up a fresh supply from the lower strata of soil, provided suitable conditions exist. To ensure capillarity the soil must be well broken up, so that the soil-particles may hold a proper amount of moisture, and also to ensure a continuity of soil-particles one with another. Lumpy soil does not hold a proper complement of water, and it also militates against capillary action. Similarly, anything of a dry or too loose character, such as long stable manure, woody-stemmed weeds, or lupins dug into the ground during the late spring or summer months, would be unfavourable to capillarity, and tend to make the soil dry. Such material should be turned under during the rainy season, as abundant moisture is required to ensure rapid decay. When this is not convenient the ground should not be cropped until the vegetable matter has rotted down to some extent.

Soil of a sandy character or that which is light and naturally dry is benefited by cow-manure or the cleanings of pigsties. Both are harmful on stiff soil, as they bind it more and exclude air. Stable or farmyard manure in a littery condition is best for stiff soil, the straw-particles tending to keep it open. The manure should not be forked into the trenches ; it should be worked in so that it intermixes with the soil. The same manures when in the state known as " fat " are good for light and medium-class land. Animal manures decay slowly, and the whole of the plant-food they contain does not become available during the year it is applied ; some of it remains in the soil till the second year.

Soil freshly manured in this manner should be used for such crops as peas, beans, cabbages, broccoli, &c., and the next season for carrots parsnips, and beet in particular, while turnips also may be grown. No additional manure will be required for either of these crops if the manuring was liberal in the previous year.

The stumps of cabbages and kindred plants should not be dug into the soil. They form harbours for wireworms, slugs, and other insect pests which shelter in the hollow stems when the centres have decayed. They may be placed in the bottom of trenched soil where they will be beyond the reach of insects, or mixed with general garden rubbish in a heap. A sprinkle of lime on the heap occasionally will keep insects away, and also prevent the growth of fungoid blights. If the heap is turned over now and again it will assist decay, and when it is wheeled on to the garden the woody stems can be thrown aside, dried, and burned. If more attention were paid to such matters, which really are not troublesome, there would be less trouble with garden pests.

ANSWERS TO CORRESPONDENTS.

IN every instance a question to which an answer is desired in the *Journal* must be accompanied by the full name and the postal address of the inquirer, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

FILLY WITH NAVEL RUPTURE.

"W. H.," Leeston :—

I have a fifteen-months-old hackney filly with a navel rupture, which was noticeable soon after she was foaled, and at six months old was about 4 in. long and about 2½ in. or 3 in. deep at centre. It has slightly diminished in substance. Would you suggest an operation? If not operated on, would rupture be likely to go against the filly for saddle or harness work, or as a brood-mare?

The Live-stock Division :—

Unless the filly is a valuable one we would advise leaving the rupture alone, at least, for a time, and try keeping her short of bulky feed, so as to reduce the size of the abdomen as much as possible without interfering with the amount of nutrition required for her growth. The less pressure there is upon the rupture from within the better. As a rule a rupture does not interfere with saddle or harness work, but we would not advise breeding from her, as there may be hereditary tendency as well as danger of extension if foaling is difficult.

SAVING LUCERNE-SEED.

"INQUIRER," North Otago :—

Kindly advise me what machine should be used to cut lucerne for seed; also whether it should be threshed with a clover-sheller or grain-thresher.

The Fields Division :—

The crop is cut when the pods are black and the leaves have practically fallen. In the lucerne-seed-growing district of Marlborough paddocks are usually closed for seed about the end of December and cut during March. The crop is cut as for hay, using a side-delivery machine. The seed crop is left lying in the swath until dry enough, when it is raked into windrows and stacked as soon as it is in condition for stacking. From the swath stage until the crop is in stack the amount of handling necessary depends altogether on weather conditions. In good drying weather it is not considered necessary to turn the swaths before gathering into windrows. It is considered advisable to leave the stack a few months before threshing. Threshing is done by an ordinary clover-sheller, the only difference being that a larger riddle is used than for clover.

PASSION-FRUIT TROUBLE.—INFESTED BLUE-GUMS.

"X. Y. Z.," Opotiki :—

1. Could you tell me what is wrong with my passion-fruit? More than half of the pods are quite empty, and a good many of the leaves have turned yellow and dropped off. On the vines there are a great number of moth-like insects with roundish oval wings which hop and jump like grasshoppers when disturbed; also a small insect with light-coloured down, which jumps in the same manner.

2. I have a lot of blue-gums from two to five years old, and the leaves are full of holes made by a yellowish-brown slug from ⅛ in. to ½ in. long. Some of the trees have died and the rest are looking very miserable. Will they be likely to recover? A few stringybarks among them do not seem to be affected.

The Horticulture Division :—

1. The insects on your passion-fruit vines are probably *Pochazia australis*. In the wingless stage these insects resemble small grasshoppers. The best means for control is to spray the vines with arsenate of lead, 1½ lb. in 50 gallons of water. It is not considered, however, that the hollow fruits are due to the depredations of the Pochazia. It is probable that the soil is unsuitable or has become impoverished. It is suggested that you use a fertilizer—say, superphosphate of lime 2 lb., bone-dust 1 lb., and sulphate of potash 1 lb., applied during winter. Allow the quantities mentioned for each plant, spreading the fertilizer over the surface to a distance of 5 ft. or 6 ft. from the plant all round. Fork the fertilizer in, and give each plant ½ lb. nitrate of soda in spring.

2. Blue-gums (*Eucalyptus globulus*) are so severely attacked in the northern districts by various leaf-eating and other insect pests that it seems injudicious to plant them, as no control measures are practicable. Stringybarks are not affected. The following varieties of gums are thought to be safe in this respect for planting: *E. coriacea*, *E. acervula*, *E. capitellata*, and *E. botryoides*.

SHEEP-DOG SUFFERING FROM FITS.

"Subscriber," Coromandel :—

Will you please advise me what to give my sheep-dog to cure him of fits? Each time I take him up on the hills mustering he is subject to them, and generally has three or four, one after another, froths at the mouth, and is very weak afterwards.

The Live-stock Division :—

Fits are only the external evidence of some disorder of internal organs. In the case of your dog it may be that he is suffering from parasites, and you should at least treat him for this by administering a vermifuge. A prescription recommended is powdered areca nut, 30 grains, and male fern extract, 20 drops. Give when the stomach is empty, followed by a drink of milk. If no worms are observed the trouble may be due to weak heart. If this is the case there is nothing we can suggest of a practical nature.

BARLEY AS POULTRY-FEED.—LIME FOR EGG-SHELL FORMING.

P. W. G. Carmichael, Oamaru :—

1. To what extent could barley be used to feed laying hens?
2. Would ordinary burnt lime be suitable to give hens to form shells?

The Live-stock Division :—

1. Without knowing what other class of food you have available, and which you propose feeding with barley, we can only say that barley by itself is an unsuitable poultry-food.

2. Ordinary burnt lime, providing it is first broken down with water, is useful as a shell-forming material. Crushed oyster-shell or other sea-shell is preferable, however, for this purpose.

DRYING BREWER'S GRAINS.

A. B. Fitchett, Wellington :—

Can you give me any information regarding the drying of brewer's grains? What sort of a machine is required, and where can it be obtained, &c. I would require to dry, say, 40 bushels a day for about four months in summer-time. The dry grains are wanted for cow-feed in the winter.

The Fields Division :—

Brewer's grains are dried by special machinery, and it is questionable if this machinery could be imported at the present time. In the Speyside district, in Scotland, where a large quantity of grains is treated, most of the drying plant is installed by James Abernethy and Co., engineers, Ferryhill, Aberdeen. Wet brewer's grains may be stored in pits much in the same way as ensilage is preserved. In this case a little common salt is usually put with them

THE CAROB-TREE AND FROST.

A. McLEAN, Mauriceville :—

Will you kindly inform me whether the carob-tree is very susceptible to frost. I obtained some seeds from the Department and have got four nice young trees from them, and would like to know if they want protection from occasional frosts the first winter.

The Horticulture Division :—

The carob-tree (*Ceratonia siliqua*) is hardy in the southern parts of England. It should therefore succeed in New Zealand, except perhaps in the coldest parts. Young trees have been uninjured by 10 degrees of frost.

SHEARING OR NON-SHEARING OF LAMBS.

"SHEPHERD," Dannevirke :—

1. If a lamb is shorn cutting, say, 2 lb. of wool, will it affect the next season's fleece to the same amount, and also decrease the staple correspondingly? 2. Do you consider that the lamb benefits in constitution by being shorn, or unshorn? 3. How is the value of the wool affected in either case?

The Live-stock Division :—

1. The weight of hogget wool will be reduced by from 1½ lb. to 2 lb., and the staple reduced in length equal to the length removed. 2. Opinions differ as to the desirability of shearing lambs. In the case of lambs intended for fattening, some hold that shearing is an advantage; but in any case lambs should only be shorn in a mild climate. 3. Owing to reduced length of staple, the wool is reduced in value by at least ½d. per pound.

VALUE OF PHALARIS BULBOSA.

"NORTH OTAGO," Palmerston South :—

Can you give me any information as to the value of *Phalaris commutata* for grazing; and also how much to sow to the acre, or would it do to sow it in a mixture?

The Fields Division :—

Phalaris commutata (or *Phalaris bulbosa*, as it should be more properly termed) has not given satisfactory results in general pasture mixtures. It has, however, been used pure in heavy soils, with fair results, but is certainly inferior to prairie-grass. Apart from providing fairly abundant winter feed, phalaris has little to recommend it, and where frosts are frequest prairie-grass will give quite as large a bulk of winter feed. For seeding pure, from 14 lb. to 18 lb. of seed is necessary. For special dairy-cow feeding, however, the following mixture is suggested: Italian rye-grass, 12 lb.; cow-grass, 4 lb.; prairie-grass, 3 bushels. The prairie would have to be sown first and then disked in, the other seeds being broadcasted or drilled after the prairie has been sown. Such a mixture should provide excellent dairy-cow feed for several years. So far as phalaris in a pasture mixture is concerned, it does not seem to endure heavy trampling by stock, and even when sown pure has to be grazed lightly in order to last.

COW WITH DRY QUARTER.

"J. W. T.," Katea :—

We have a good cow which came in with one teat practically closed, only a very little milk coming from it. We milked this quarter for a fortnight by the aid of a milk-tube, but as the improvement was very slight we then gave it up, fearing an injury to the udder. Will you please tell me whether it is possible to reopen the duct?

The Live-stock Division :—

From your description it appears that the quarter is practically dry, and that the milk-duct is not so much at fault. We would recommend that the quarter be allowed to dry off, because if it is not possible to open, and keep open, the duct by the aid of a milk-tube, any other operation is not likely to be successful.

APPLES FOR POULTRY-FEED.

"SUBSCRIBER," Paeroa :—

Will you kindly inform me whether a mash made of apples boiled till tender, and mixed to a proper consistency with pollard, is a suitable food for fowls once a day, either for laying hens or young birds ?

The Live-stock Division :—

It would be unwise to give either class of poultry apples in the form mentioned. This is chiefly because, being of a laxative nature, they would have the effect of bringing on scouring and other similar disorders, which would necessarily interfere with the birds' laying-power. The only safe way to feed apples to poultry is to throw them into the run whole for the birds to pick at. This will enable each bird to take what it needs, and nature will generally guide it in this respect. Of course, the birds must be given at least two good meals a day of grain-stuffs, so that, through force of hunger, they are not compelled to eat more apples than is good for them.

BADLY YIELDING CHERRY-TREE.

"AMATEUR," Invercargill :—

Kindly suggest suitable treatment for a cherry-tree which is covered with blossoms in spring, but which yields very little fruit.

The Horticulture Division :—

The variety may be one that will not crop well. Only a few varieties give good crops. Your soil may not be suitable ; cherries require a rather deep and friable soil and good drainage. Frost may injure the blossoms and prevent pollination, or there may be overproduction of blossoms. This often results in a general weakness of individual flowers, and they may be quite incapable of fertilization. If this is the case, it may be remedied by a general shortening of flowering-twigs so as to reduce the number of flowers. Those left, being strengthened, may enable them to fertilize properly, and a crop may be secured.

PLANTING LAUREL AND POPLAR CUTTINGS.

"CANTERBURIAN," Sefton :—

Please state the best time and how to plant laurel-cuttings for garden-hedge, also poplar-cuttings for orchard boundary.

The Horticulture Division :—

Laurel cuttings : Young growths are taken with a few inches of older wood attached. The piece taken will generally consist of a chief shoot and several small side growths. Trim off any shoots or leaves from the lower 3 in. or 4 in., cut the base level just below a joint, and shorten the main shoot to about the level of the others. The cutting should now be from 8 in. to 10 in. long. Plant it half its length in the soil, making the base very firm by treading the soil around it. If the cuttings are to be set in their permanent position the soil should be trenched at least 18 in. deep, and not less than 30 in. wide. Plant any time from end of April to August.

Poplar cuttings : These may be made almost any length according to circumstances. If the soil is good and rainfall fairly abundant, they may stand 5 ft. out of the ground when trimmed. Take healthy growths about 8 ft. long, and trim off bottom branches. With a crow-bar make a hole 18 in. deep, push the cutting down to the bottom of the hole, and tamp in firmly with the flat end of the bar or a fencing-rammer. When the row is all in cut the tops to a uniform height. When the soil is poor or rainfall light, the cuttings must be shorter, and it may be best to dig out a trench and plant with a spade. In any case tamp the base of cuttings firm. Plant any time during the dormant period.

THE "SCOTTISH JOURNAL OF AGRICULTURE."

WE have received the first number of the *Scottish Journal of Agriculture*, issued by The Board of Agriculture for Scotland. It resembles in size and get-up the *Journal* of the English Board of Agriculture, and will be published quarterly. The contents of a strong first issue comprise among other Scottish features articles on "Oat-growing in Scotland," "Some Effects of the War on Scottish Forestry," and "Food-production in Scotland." In the course of an introductory note the Right Hon. Robert Munro, Secretary for Scotland, remarks as follows :—

"The publication of the paper could not, I think, take place at a more opportune time. As the instrument for the development of both agriculture and forestry in Scotland, the Board of Agriculture can, by means of the *Journal*, provide much useful information to its readers, and can stimulate and popularize these vital industries. Agriculture and forestry in Scotland have, in my judgment, a great future. The motor-tractor has come to stay. Other labour-saving devices will follow in its wake. The use of fertilizers will be extended ; the improvement of seeds and plants will be undertaken on a scale hitherto undreamt of ; the prevention and elimination of plant and animal diseases will be vigorously tackled : in short, a new outlook has been compelled by the war. The essential value of agriculture and forestry to the country is at last realized ; the national danger involved in their neglect is at last appreciated ; their complementary character is at last understood. By means of these industries the security of the nation can be assured, and a robust and industrious peasantry settled upon the land."

We wish the *Scottish Journal* every success.

THE BRITISH EMPIRE PRODUCERS' ORGANIZATION.

THE British Empire Producers' Organization, a body which has its headquarters in London, and is composed of representative British associations directly interested in production and manufacture throughout the Empire, has issued an informative pamphlet regarding its aims and objects, &c. The Organization is stated to be independent of all political parties in Great Britain or the Empire overseas. No member of any Parliament in the Empire is eligible for a seat on the Council. The aim of the Organization is to promote, defend, and develop the resources of the British Empire, to keep them free from foreign control, and to this end to assist in carrying into effect the resolutions of the Paris Economic Conference, June, 1916. The policy of the Organization is designed to give security to industry throughout the British Empire, and to encourage technical efficiency, energy, and enterprise. To that end it seeks—(1.) To make the Empire self-supporting in all essential industries by—(*a*) Ensuring that the food-supplies of the Empire shall be primarily secured for the use of the British peoples and produced in such abundance as to maintain a reasonable level of prices (this applies particularly to Great Britain, where the necessity for a large development of agriculture is most urgent) ; (*b*) conserving and developing the resources and raw materials of the Empire for the use in the first instance of its own industries. (2.) To advocate such measures as shall secure the control in British hands of transport facilities between the various parts of the Empire. (3.) To ensure the placing of all Government orders and public-works contracts within the Empire. (4.) To secure for the workers better conditions of life, work, and wages than existed before the war. The membership of the Organization is formed by industrial associations, who nominate their representatives for election to the Council, which in turn elects from among its number a general executive to direct the work. Thus the control rests entirely with organized industrial groupings. Individuals or firms of British nationality desiring to support and take a personal and active part in the work of the Organization can do so by registering as associates. Among the patrons of the Organization is Mr. Massey, Prime Minister of New Zealand, and Sir Joseph

Ward is one of the Vice-Presidents. New Zealand bodies named as supporting the policy of the Organization are the New Zealand Farmers' Union, the New Zealand Ironmasters' Association, and the All for Empire League (Wellington). The address of the Organization is Kingsway House, Kingsway, London.

PEDIGREE SEED-WHEAT.

THE Canterbury Seed Growers' Association has now been in existence for three years, and has multiplied to a considerable extent the pure seed-wheats that have been produced at Lincoln College. The following varieties are now available: College Hunters, True Pearl, Solid-straw Tuscan, and Purple-straw Tuscan. All the seed available for sale was inspected while the crop was growing and into the mouth of each sack is sewn a certificate stating that the seed contained is true to name, relatively pure, and free from noxious weeds. Inquiries for seed should be made to Dr. Hilgendorf, Lincoln College, Christchurch, who is acting as Honorary Secretary to the Association.

WHEAT AND OATS THRESHINGS.

ACCORDING to a statement issued by the Government Statistician, returns of actual threshings throughout the Dominion received up to 14th March from threshing-mill owners show that till then 891,342 bushels of wheat and 738,821 bushels of oats had been threshed out. The general average yields per acre in cases where particulars were furnished worked out at 26·54 bushels for wheat and 30·81 bushels for oats. On these threshings, in wheat Canterbury averaged 27·07 bushels, Otago 28·21 bushels, Marlborough 19·04 bushels, and Wellington 21·11 bushels. In oats Canterbury averaged 28·60 bushels, Otago 38·58 bushels, Southland 39·76 bushels, Marlborough 27·36 bushels, and Wellington 31·23 bushels.

Importation of Fowl-wheat.—It is notified by the Comptroller of Customs, Wellington, under date 27th March, 1918, that the Board of Trade will be prepared until further notice to consider favourably applications for permission to import fowl-wheat from Australia. Intending importers should forward applications to the Comptroller, stating the quantity they desire to import, also date when and port where the wheat is to be imported.

Maximum Prices of Grass-seed and Clover-seed.—An Order in Council, dated 23rd March, 1918, fixed such prices in the following terms: The maximum price of grass-seed and clover-seed shall be the standard price thereof on the 11th day of March, 1918—that is to say, in respect of every locality the current price at which on that day goods of the same nature and quality were saleable in that locality when sold in the same quantity and on the same terms as to payment, delivery, and otherwise.

FORTHCOMING SHOWS.

N.Z. Fruitgrowers' Federation: National Apple Show, at Auckland, 1st to 4th May.

Southland A. and P. Association: Winter Show, at Invercargill, 14th and 15th May.

Otago A. and P. Society: Winter Show, at Dunedin, 28th to 31st May.

Waikato Winter Show Association: Show, at Hamilton, 4th to 8th June.

Manawatu and West Coast A. and P. Association: Winter Show, at Palmerston North, 18th to 21st June.

A Marlborough Homestead.